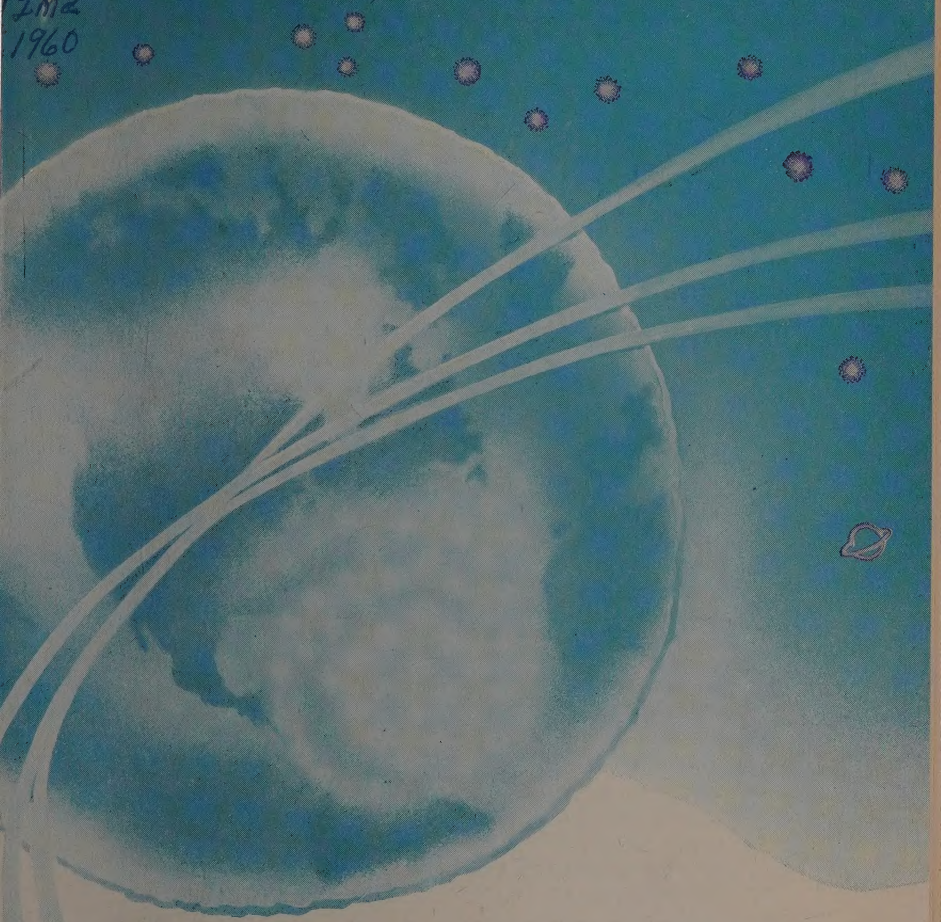
555
.12M2
1960

AMERICAN METEOROLOGICAL SOCIETY



Meteorological & Geoastrophysical ABSTRACTS

UNIVERSITY OF ILLINOIS
MAR 15 1961
CHICAGO

Vol. 11 OCTOBER 1960 No. 10

METEOROLOGICAL AND GEOASTROPHYSICAL ABSTRACTS

**Editor and Supervisor: MALCOLM RIGBY (Washington)
#Business Manager: KENNETH C. SPENGLER (Boston)
Corresponding Editor: *DR. ANDRE VANDENPLAS (Uccle, Belgium)
Corresponding Analyst: *DR. I. L. DORDICK (Chicago, Ill.)
Corresponding Analyst: *RONALD BAKER (Harrow, Eng.)

EDITORIAL STAFF (Washington)

Assistant Editor (Publications): MARY L. RICE
Chief Bibliographer (Accessions): GEZA THURONYI
Chief Cataloger: DOROTHY M. GROPP
Chief Indexer: *MARINA SZE
Technical Editor: HAFEEZ MALIK

Bibliography

ELEMER KISS
ANDREW J. MEGLIS
OTTO TABORSKY

Abstracting

EVELYN Z. SINHA
KIWON CHUNG
AHMED KHAN
NNDEM E. U. NNDEM
WILHELM NUPEN
*ALEXIS M. POUSHKIN
ISMAIL SAAD
*NICHOLAS P. SETCHKIN

Cataloging

*BEVERLY HUGHES
*BARBARA H. KING
*MARGARET MATTHEWS
*SHIRLEY PANARA
*LAURA I. PETERSON

Indexing

*MURIEL F. HAAS
*WINIFRED SCHRAITLE
*MARY B. DENNY
*SUSAN MANOVILL
*HELEN THURONYI
*RUSSELL G. CADY

Processing

*EDITH N. HAUPT
*DORIS G. NICKEY
*MILDRED CARROLL
*KATHERINE MARTINOFF
*HELEN I. RICKELS
*RUTH S. GARVEY

* Part time.

**EDITORIAL OFFICE: Washington, D. C. P.O. ADDRESS: Box 1736, Washington 13, D. C. Telephone: REpublic 7-6278.

#ADMINISTRATIVE OFFICE: American Meteorological Society. Office of Executive Secretary, 45 Beacon Street, Boston 8, Mass.

Address all business communications, orders and inquiries to the Executive Secretary, Mr. Kenneth C. Spengler, 45 Beacon Street, Boston 8, Mass. Exchanges and reprints may be sent direct to P. O. Box 1736, Washington 13, D. C.

METEOROLOGICAL AND GEOASTROPHYSICAL ABSTRACTS is a monthly publication devoted to:

A. Current Abstracts in English on important meteorological and geoastrophysical literature in every language.

B. Bibliographic references to other items of interest to the profession.

C. Selective, annotated bibliographies on subjects of immediate and special interest to meteorologists, geophysicists and astrophysicists.

SUBSCRIPTION RATE: $60 ($15.00 per year to members). Prices for single copies $10 ($5 to members); back issues $6 ($3 to members); back volumes $30 ($15 to members); Vol. 1–10 complete, $200 ($100 to members).

METEOROLOGICAL AND GEOASTROPHYSICAL ABSTRACTS

MALCOLM RIGBY, Editor

Vol. 11 October 1960 No. 10

AGRICULTURE · COMMERCE · AERIAL AND MARINE NAVIGATION · PUBLIC HEALTH · INDUSTRY · ENGINEERING
AMERICAN METEOROLOGICAL SOCIETY
1919

Supported by
DEPARTMENT OF THE AIR FORCE
DEPARTMENT OF THE ARMY
DEPARTMENT OF THE NAVY
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NATIONAL SCIENCE FOUNDATION
UNITED STATES WEATHER BUREAU

Special Feature in This Issue

Annotated Bibliography on Satellite Meteorology
By
Elemer Kiss

(*For table of contents see back cover*)

Published monthly at Prince and Lemon Streets, Lancaster, Pa., by the AMERICAN METEOROLOGICAL SOCIETY, 45 Beacon Street, Boston 8, Mass.

Printed and issued by: Lancaster Press, Inc.

FOREWORD

Meteorological and Geoastrophysical Abstracts is a monthly publication devoted to current literature in meteorology, geophysics and astrophysics.

Part I contains abstracts of current literature in the fields of meteorology, etc.

Part II of each issue comprises an annotated bibliography of important references on a special subject. Bibliographies published in the successive issues were:

Vol. I, 1950

1. Atmos. Pollution	2. Aerobiology	3. Cloud Physics	4. Hail
5. Tornadoes	6. Volcanic Dust	7. Climat. Changes	8. Thunderstorms
9. Icing	10. Acoust. Propagation	11. Evaporation	

Vol. II, 1951

1. Extended Forecast.	2. Long Range Forecast.	3. Soil Temp.	4. Constants, etc.
5. Clim. of Near East	6. Clim. of Middle East	7. Special Winds	8. Radar Storm
9. Condensation Trails	10. Clim. of N. E. Africa	11. Mountain Met.	Detect.

Vol. III, 1952

1. Clim. of N. W. Africa	2. Carbon Dioxide	3. Clim. of Argentina, etc.	4. Dew
5. Objective Forecast.	6. Stratus Forecast.	7. Urban Climatology	8. Clim. of C. Africa
9. Visibility	10. Glaze and Rime	11. Free Air Turbulence	

Vol. IV, 1953

1. Turbulence Theory	2. Turbulent Diffusion	3. Frost	4. Clim. of Australia, etc.
5. High Level Winds	6. Winds in Stratosphere	7. Jet Stream	8. Radiation Bioclim.
9. Clim. of Pacific	10. Auroras	11. Sferics	

Vol. V, 1954

1. Oceanog. Met.	2. Clim. of S. E. Asia	3. Auroral Physics	4. Tropopause
5. Balloons	6. Numerical Forecast.	7. Radiation Data	8. Vertical Motion
9. Clim. of Arctic	10. Industrial Met.	11. Wind Waves and Swell	

Vol. VI, 1955

1. Bibliog. of Bibliog.	2. Texts & Monogr. Bibliogs.		3. Storm Surges
4. Ionospheric Prop.	5. Photochem.—Upper Atmos.		6. Cloud Physics
7. Radar Cloud Physics	8–9. Atmos. Nuclei	10. Weather Modification	11. Cooling Power

Vol. VII, 1956

1. Synoptic Met.-Arctic	2. Clim. of Enclosed Spaces	3. Cosmic Rays (–1952)
4. Cosmic Rays (1953–56)	5. Atmos. Radioactivity	6. Inversions
7. Snow Micromet.	8. Snow Micromet. (Suppl.)	9–11. Tropical Cyclones

Vol. VIII, 1957

1. Solar Weather Relations	2. Night Airglow	3. Forecasting Special Elements
4. Forest Micrometeorology	5. Hydromet. Forecasting	6. Numerical Forecast. (Suppl.)
7. Albedo 8. Meteors	9–10. Tropospheric Prop.	11. Medical Meteorology

Vol. IX, 1958

1. Radioastronomy	2. Solar Astrophysics	3. Radioactivity in Atmosphere
4. Waves and Currents	5. Physical Oceanog.	6. Dynamic & Phys. Oceanog.
7. Long Range Forecast.	8. Radar Met. 9. Cosmic Rays	10–11. Geomagnetism

Vol. X, 1959

1. Works of C. E. P. Brooks	2. Tornado Forecasting	3. Soil Moisture	4. Sferics
5–6. Ozone	7. Acoustic Waves	8. Evaporation Measurement	
9. Evapotranspiration (–1955)	10. Evapotranspiration (1956–1959)		11. Evaporation

Vol. XI, 1960

1. Outstanding Reference Works	2. Outstanding Texts	3. Numerical Forecast. (Suppl.)
4. Ionospheric Physics	5. Ionospheric Propagation	6. Ionosphere
7. Forecast Verification	8. Radar Meteorology	9. Rocket Meteorology
10. Satellite Meteorology	11. Airglow	

Other bibliographies in preparation are:

Aurora	*Limnology*	*Precipitation Chemistry*
High Atmosphere Temperatures	*Physics of Lightning*	*Twilight Phenomena*

Part III contains a listing of reviews, translations, reprints, and the contents of important publications. These are published in the earliest issue where space permits.

Part IV is made up of author, subject and geographical indexes. The December issue comprises cumulative author, subject, geographical and journal indexes.

EXPLANATIONS

Location of material: For each entry, a symbol is given for at least one library where the material may be found. The Union List of Serials (Gregory) is the source of most of the symbols used. In some cases, where no symbol has been assigned to a library, one will be devised according to the principles of the Union List.

Library symbols used frequently may be found in the following list:

DA:	U. S. Dept. of Agriculture Library, Washington, D. C.
DBS:	U. S. Bureau of Standards Library, Washington, D. C.
DGS:	U. S. Geological Survey Library, Washington, D. C.
DLC:	Library of Congress, Washington, D. C.
DN-HO:	U. S. Navy Hydrographic Office Library, Suitland, Md.
DNLM:	U. S. National Library of Medicine, Washington, D. C.
DSI:	Smithsonian Institution, Washington, D. C.
DWB:	U. S. Weather Bureau Library, Washington, D. C.

Other symbols:

*	before an entry indicates a good data source.
†	before an entry indicates a good bibliography.
§	before an entry indicates a synoptic case history study accompanied by charts.
Ⓢ	after an abstract indicates an abstract prepared for NASA.

Geographic locations are in the English form rather than the form used locally, for example, Moscow for Moskva.

Titles of articles or monographs are in the language of the original article unless otherwise stated. Slavic (Cyrillic) titles are transliterated into the Roman alphabet using a modification of the Library of Congress transliteration scheme.

Abbreviations:

Titles of periodicals are not abbreviated, as a rule.

The months of the year from March to July are not abbreviated. Other months are abbreviated as Jan., Feb., Aug., Sept., Oct., Nov., and Dec.

The word or abbreviation for Volume (Tom, Band, Jahrgang, Año, etc.), for Number (Heft, Fascicule, Vypusk, etc.) and for page or pages is omitted from most entries. Thus an entry will read as follows:

Meteorologische Rundschau, 2(5/6):146–151, May/June 1950.

This indicates that the article appeared in *Meteorologische Rundschau*, *Jahrgang* 2 (Vol. 2), *Heft* 5/6 (No. 5/6), *pages* 146–151, May/June 1950.

PART I. ABSTRACTS OF CURRENT METEOROLOGICAL AND GEOASTROPHYSICAL MATERIAL

A. GENERAL

1. MAJOR WORKS—TEXTBOOKS

11.10–1 551.510.522:551.584:63

*Leningrad. Glavnaia Geofizicheskaia Observatoriia, **Sovremennye problemy meteorologii prizemnogo sloia vozdukha: sbornik statei.** [Current problems on the meteorology of the air layer near the ground: collection of articles.] Leningrad, Gidrometeoizdat, **1958.** 232 p. figs., map (fold.), tables, refs., eqs. **DLC** (QC982.7.L4)—This volume contains 14 articles read at a Council of the G.G.O. on May 7–10, 1957 by prominent Soviet micro- or agrometeorologists (e.g. D. L. Laĭkhtman, M. P. Timofeev, M. F. Zuev, A. M. Obukhov, B. A. Aĭzenshtat, M. E. Berliand, M. S. Sternzat, F. F. Davitaia, M. I. Budyko and others) on current problems of micrometeorology, especially those concerning uninvestigated portions of the U.S.S.R. and the Antarctic. Not only the theoretical aspects are investigated, but a great deal of data are presented and analyzed synoptically, statistically and climatologically. Some of the specific problems studied are the meteorology of the surface air layer of the Antarctic and the Arctic; heat balance of water reservoirs and evaporation estimates; heat balance of Kara Kul, and of desert regions, temperature and wind microstructure in the ground layer; local forecasts of temperature and moisture changes in the ground layer, aerological studies; fog formation and dissipation, instrumentation for micrometeorology; micrometeorology of crops; biological effects of temperature in microclimatic layer; single station evaluation of climatic controls, etc. Extensive data tables and derived graphs, scatter diagrams, nomograms, etc., bibliographies to Russian source material are included throughout, and even a large colored chart is presented. *Subject Headings:* **1. Micrometeorology conferences 2. Micrometeorology studies of U.S.S.R. 3. Heat balance of Earth 4. Soviet Arctic 5. Antarctica. I. Budyko, M. I.** (*ed.*).—*M.R.*

11.10–2 551.593.5:551.510:551.501.4

*Coulson, Kinsell L.; Dave, Jitendra V. and Sekera, Zdenek, **Tables related to radiation emerging from a planetary atmosphere with Rayleigh scattering.** Berkeley, Univ. of California Press, **1960.** 548 p. 10 p. of text (pref.). Almost entirely tables. Price: $12.50. **DLC**—A large volume devoted to extensive tables of downward and of upward radiation from the bottom and the top, respectively, of the atmosphere for 7 values of optical thickness τ, 7 values of zenith distance of the sun μ_0, 16 values of zenith distance of the diffuse radiation μ, 7 values of azimuth angle of the diffuse radiation from the sun's vertical ϕ (0°, 30°, 60°, 90°, 120°, 150°, and 180°) and 3 values of ground reflectivity A (0.00, 0.25 and 0.80). The parameters for which the above values are tabulated are: 1) total intensity I, 2) Stokes parameter Q, 3) Stokes parameter U, 4) degree of polarization P, and 5) angle X between plane of polarization and vertical plane at the given azimuth for the upward and the downward radiation, respectively. In the 10 sets of tables there are 142,688 values out of a possible 263,424. The tables are arranged in a convenient form and bound in high quality binding with explanations and background theory in preface. The calculations are based on an exact solution by CHANDRASEKHAR to the Rayleigh transfer problem (1871), using as an aid G. G. Stokes's paper **On the composition and resolution of streams of polarized light from different sources** (1852) for the case of reflected and transmitted light in a plane-parallel atmosphere. It is also possible to obtain by subtraction from observed distributions the nonmolecular component of skylight. *Subject Headings:* **1. Rayleigh scattering tables 2. Radiation from planetary atmospheres 3. Skylight polarization 4. Radiation tables. I. Stokes, G. G. II. Chandrasekhar, S.**—*M.R.* ©

11.10–3 538.69:523.1(02)

†Dungey, J. W. (*King's Coll. Newcastle upon Tyne*), **Cosmic electrodynamics.** Cambridge Univ. Press, **1958.** 183 p. numerous figs., 4 tables, numerous eqs., bibliog. p. 175–182. (*Cambridge Monographs on Mechanics and Applied Mathematics.*) Price: 32 sh 6 d. **DLC** (QC809.E55D8). Review by E. V. Appleton in **Journal of Atmospheric and Terrestrial Physics,** N. Y., 17(1/2):179, Dec. **1959.**—A concise textbook covering systematically the basic theory of cosmic electrodynamics or magneto-hydrodynamics applicable to astrophysics but specifically to electromagnetic phenomena of the sun, aurora and ionosphere, and the acceleration of cosmic rays. The first chapter covers definitions, orders of magnitude and orbits; Ch. 2 the velocity distribution method; 3) motion of magnetic fields; 4) magnetostatics; 5) Magnetodynamics; 6) acceleration of charged particles in magnetic fields and dust turbulence; 7) solar phenomena; 8) magnetic storms and auroras and 9) ionospheric electrodynamics. The extensive bibliography is arranged roughly by the above headings. *Subject Headings:* **1. Cosmic electrodynamic textbooks 2. Magneto-hydrodynamics.**—*M.R.*

11.10–4 533.1:531.787

*†Belik, N. I., **Pribory dlia izmereniĭ malykh raznosteĭ davleniĭ gazov: teoriia, metody issledovaniĭ i poverka.** [Instruments for measuring small differences in the pressure of gases: theory, methods of investigation and verification.] Moscow, Gosud. Nauchno-Tekhnicheskoe Izdatvo Mashinostroitel'noĭ Literatury, **1957.** 226 p. 91 figs., 30 tables, 67 refs., 557 eqs. **DLC** (QC165.B43)—A small technical book covering recent (–1954) theoretical and experimental methods of construction, operation and verification of instruments for measuring slight differences in air or gas pressure (micromanometers). Physical concepts, units, theoretical basis for construction and measurement of small gas pressures; errors; types; critique of various types and their accuracy; experimental methods of research; research on highly sensitive micromanometers; use and calibration or testing of same. The bibliography is about half devoted to Russian and half to western literature. *Subject Headings:* **1. Micromanometers 2. Gas pressure measurement.**—*M.R.*

2. POPULAR SCIENCE BOOKS

11.10–5 551.582.2/3(477)

*Huk, M. I.; Polovko, I. K. and Prikhot'ko, G. F., **Klimat Ukraïns'koï RSR.** [Climate of the Ukraine.] Kiev, Radians'ka Shkola, **1958.** 69 p. figs., map, 6 refs. **DLC** (QC989.R5U45)—A pamphlet giving basic facts and data on the climate of the Ukraine, history of observations and study of climate of Ukraine, climatic controls, circulation, climatic disasters, wind energy, temperature of soil and air, humidity, precipitation, thunder, lightning, hail, dew, drought, dry winds, winter climate, regional climates in Ukraine and effects of climate on human activity. Many tables of illustrative data on each subject and several climatic charts are enclosed. *Subject Headings:* **1. Climate of Ukraine, U.S.S.R. 2. Ukrainian S.S.R.**—*M.R.*

3. HANDBOOKS—MANUALS

See also: **Space Aeronautics Res. and Development Handbook,** 11.10–26.

11.10–6 551.511.33:551.513.1

†Fultz, Dave; Long, Robert R.; Owens, George V. et al. (*all, Hydrodynamics Lab. Dept. Meteor. Univ. Chicago*), **Studies of thermal convection in a rotating cylinder with some implications for largescale atmospheric motions.** *Meteorological Monographs* [American Meteorological Society], Boston, 4(21):1–104, Dec. **1959.** 100 figs., table, 90 refs., 47 eqs. **DWB, DLC**—The results of experiments in thermal convection performed at Hydrodynamics Laboratory of the University of Chicago, are presented. The experiments starting in 1947 aimed to attain models of atmospheric, geophysical and astrophysical phenomena of a hydrodynamic kind. A brief historical survey traces the development of the background from early investigations. The apparatus, rotating cylindrical containers provided with heat sources and sinks and the methods of operation are described. The pertinent equations were developed for comparison with the prototype. The modeling criteria were investigated in

terms of the appropriate nondimensional parameters. The rotation and heating rates represent the most important variables. A nondimensional parameter, the Rossby number, was defined, to determine the observed motions. A high Rossby number determines a motion (Hadley regime) symmetric to the heat transport accompanied by ageostrophic components of the flow. A low Rossby number characterizes the wave regime. The fundamental assumptions as to the hydrodynamic nature of large scale atmospheric behavior are supported by the experimental successes. The richly annotated illustrations are indispensable for the elucidation of the work in its theoretical as well as in its empirical aspects. *Subject Headings:* **1. Rotating cylinder experiments 2. Atmospheric circulation experiments. I. Bohan, Walter II. Kaylor, Robert III. Weil, Joyce.**—*O.T.*

4. MONOGRAPHS

See also: **Climate of Estonia** (Kirde), 11.10–376.

11.10–7 551.589(443/444)

*†Pédelaborde, Pierre (*Faculty of Letters of Toulouse*), **Le climat du bassin parisien: essai d'une méthode rationnelle de climatologie physique.** [Climate of the Paris basin: attempt at a rational method of physical climatology.] Paris, M. R. Genin, **1957.** 539 p. tables, numerous foot-refs., bibliog. p. 505–530 (776 refs.). **DLC** (QC989.F8P3). Also: **Atlas.** Paris, **1958.** 1 vol. (unpaged), with 116 plates (incl. maps and tables). **DLC** (QC989.F8P3 Atlas).—A magnificent 2 volume synoptic climatological study of the region around Paris, based on extensive climatological and synoptic data and charts. The second volume is entirely devoted to charts illustrating the various synoptic types in each season, plus topographic maps, Jan., April, July and October precipitation in the region, cloud system, humidity, frost, snow, temperature, vegetation, with temperature in Mediterranean and other climatological charts and tabular data corresponding to charts. *Subject Headings:* **1. Synoptic climatology of Paris Basin 2. Synoptic types in France 3. Climate of Paris Basin 4. Paris Basin, France.** —*M.R.*

11.10–8 551.582.2(661.1)

*†Dubief, Jean, **Le climat du Sahara, Vol. 1.** [Climate of the Sahara, Vol. 1.] *Algiers. Université. Institut de Recherches Sahariennes, Mémoire* (hors série), **1959.** 312 p. 190 figs., 109 charts, 121 tables, bibliog. at end of each ch. (90 refs.). **DWB**—This very detailed study of the climate of the Sahara is based on observations made at some 160 stations (period 1926–1950) distributed in the different regions of the Sahara between the Atlantic Ocean and the Red Sea. This book dealing with thermal phenomena is divided into two parts: the first comprises 2 chapters, the second is subdivided into 7 chapters. The first chapter of Pt. 1 gives a historical account of observations in the Sahara, which started in 1819, and recalls the birth and development of the Algerian Meteorological Institute (1878) and of the Institute for Meteorology and Terrestrial Physics in Algeria (1931). The second chapter concerns the saharian climatological network, which in the course of years met with numerous vicissitudes. The period 1926–1950 chosen by the author seems to be most homogeneous. The second part starts (Ch. I) with the study of cloudiness. Annual and monthly mean cloudiness data are reported in tables. The annual variation of cloudiness according to latitude is examined and charts indicate the geographic distribution of this element during the various months of the year. Chapter II deals with sunshine: average daily sunshine duration month by month, annual variation and geographic distribution of annual and monthly durations. Chapters III and IV treat respectively of solar radiation and soil radiation. In these regions soil temperature plays a very important part in the climatology of the low layers of the atmosphere and Chapter V supplies much detailed information on this subject. The mean and extreme temperatures of the soil surface, their frequencies, their diurnal and annual variations are successively analyzed. The differences between the minimum temperatures at soil level and under screen are examined. A chart indicates the boundaries of the regions where the surface temperature can fall below 0° in the course of the year. The sand temperature at the surface, at various depths and the temperatures of Saharian houses are also investigated. Chapter VI, headed **Temperature in the open air,** starts with a survey of the altitude and temperature of the

tropopause over the Sahara. The mean temperatures of the isobaric surfaces are given for the levels 700 mb, 500 mb and 200 mb; also the mean altitude of the 0° isotherm, etc. Examining the temperatures of the low layers of the atmosphere it is found that the temperature gradient near the surface shows very large variations in the first 50 cm above the ground. In Chapter VII which deals with the air temperature under screen one finds, in addition to the classical characteristics of this element, a study of accidental variations of temperature and their causes and also some reflections on the secular variation of temperature. The nomenclatures of tables, figures and charts are indexed at the end of the book. Volume II, entitled **"L'eau atmosphérique au Sahara"** [Atmospheric water in the Sahara], is being prepared and will be published shortly. *Subject Headings:* **1. Climate of Sahara 2. Climatic data 3. Sahara.**—*A.V.*

11.10–9 631.48(678.2)

*Anderson, Brian, **Survey of soils in the Kongwa and Nachingwea Districts of Tanganyika.** Dept. of Agricultural Chemistry, Faculty of Agriculture and Horticulture, Univ. of Reading (England) in conjunction with Tanganyika Agricultural Corporation, **1957.** 120 p. 24 photos and figs. (some fold.), 26 tables. **DLC** (S599.T25A7). Review by R. M. S. Perrin in *Nature*, London, 184(4703):1901, Dec. 19, **1959. DLC**—The surveys presented in this book were carried out in two districts of Tanganyika during 1950–54. The first site was at Kongwa in Central Province with a mean annual rainfall of about 20 in., and the second at Nachingwea in Southern Province where the rainfall is about 35 in. but the population is very sparse due to tsetse fly and other factors. The discussion, divided into four major chapters, first surveys the two sites, describing the general features and classifying the soil series. Then the soil maps are described and the development of the soils of Kongwa and Nachingwea and their relation to other tropical soils are discussed. The study is extensively illustrated by photographs and sketches. *Subject Headings:* **1. Soil classification 2. Tanganyika.**—*I.S.*

11.10–10 551.508(02)

Novikov, A. I., **Meteorologicheskie i aerologicheskie pribory: remont i regulirovka.** [Meteorological and aerological instruments, repair and calibration.] Ed. by N. P. Rusin. Leningrad, Gidrometeoizdat, **1952.** 94 p. 56 figs., 7 refs. (Continuation of author's **Meteorologicheskie pribory,** pub. **1952,** *see* 5.7–42, July 1954, *Met. Abstr.*) **DLC** (QC876.N64)—A pamphlet-type manual giving details of standard instruments used by the Hydrometeorological Service in the U.S.S.R. in continuation of those treated in the author's 1952 manual: barometers, thermometers and psychrometers. The present manual covers wind direction and speed instruments and recorders, rain and snow recorders; sunshine recorders, actinometers, theodolites and pilot balloon equipment for land and sea stations, meteorographs and radiosondes. Instructions for installation, maintenance, calibration, repair, etc. are included with numerous drawings and photographs. *Subject Headings:* **1. Meteorological instruments 2. Aerological instruments 3. Instrument manuals. I. Rusin, N. P.** (*ed.*).—*M.R.*

5. NEW SERIALS

11.10–11 551.507.362.2(05)

Iskusstvennye Sputniki Zemli [Artificial Earth Satellites], No. 1, **1958.** Latest issue seen, No. 5, **1960.** Issued Moscow by the Akademiia Nauk SSSR. **DWB, DLC.** Complete translations of all articles in Nos. 1 and 2 have been issued as **Artificial Earth Satellites,** Vol. 1–2, by Plenum Press, N. Y.; Chapman & Hall, London, **1960.** 2 vol. bound in 1 (120 and 107 p.) figs., tables, refs., eqs. **DWB** (629.1388 A 791ar)—In order to disseminate widely the results of the investigations with artificial earth satellites carried out in the U.S.S.R., the Academy of Sciences of the U.S.S.R. decided to issue regularly collections of articles entitled **Iskusstvennye Sputniki Zemli.** The first such collection contains papers dealing with the results obtained by means of the first and second Soviet satellites; the second issue contains of the third Soviet satellite; Nos. 3 (124 pages) and 4 (205 pages) contain 28 papers on calculation of orbits, atmospheric density and meteoric parameters, and results of observations on cosmic rays, ion mass spectra, etc., based on the first three Soviet satellites; No. 5 is mainly devoted to various types of measurements made by the second Soviet cosmic rocket on its

flight past the moon, including photographs of the far side of the moon. English summaries of all articles in No. 3 have been issued as *U. S. National Aeronautics and Space Administration, Technical Translation*, F-8, April **1960.** 11 p. Complete translations of these same articles also issued separately in the *Technical Translation* series. (For contents of Nos. 1 and 2 *see Met. Abstr.*, 10(11):1778–1779, Nov. **1959**; for contents of No. 3 *see Met. Abstr.*, 11(6):978–979, June 1960.) All articles are being abstracted separately. *Subject Headings:* **1. Soviet satellites 2. IGY satellite program 3. New serial publications.**—*I.L.D., G.T.* Ⓢ

6. GLOSSARIES

11.10–12 629.13(030.8)

†Adams, Frank Davis, **Aeronautical dictionary.** Wash., D. C., U. S. Govt. Printing Office, **1959.** 199 p. figs., bibliog. p. 186–199. At head of *t-p.*: National Aeronautics and Space Administration. **DLC** (TL509.U675 1959)—A new and fairly complete glossary of over 4000 terms used in aeronautics and related fields such as navigation, meteorology, hydrodynamics, radio technology, engineering, medicine, etc. Numerous cross-references and a few illustrations appear throughout the work. Grammatical forms are indicated for each term. Most of the terms are fully defined, some with historical notes and some with special definitions, where meanings are different in different disciplines. *Subject Headings:* **1. Aeronautical dictionaries 2. NASA dictionary.**—*M.R.* Ⓢ

7. IGY—ARCTIC—ANTARCTIC

See also: **Meteorology of air layer near ground** (Leningrad. GGO), 11.10 1; **Shortwave fadeouts without flares** (DeMastus, Wood), 11.10–75; **Cosmic ray work at Bengal Eng. Coll.** (Chakrabarty), 11.10–128; **IGY cosmic ray program** (Chasson), 11.10–129; **Polish auroral observations, 1958** (Kosibowa), 11.10–174; **Atmospheric whistlers** (Helliwell, Morgan), 11.10–208; **Ten-millibar weather maps July 1957–June 1958** (U. S. Weather Bureau), 11.10–230; **Arctic circulation studies** (Reed), 11.10–287; **Disturbed circulation in Arctic stratosphere** (Hare), 11.10–290.

11.10–13 621.317:550.3:551.506.22

Brunt, David (*Chairman of Electricity Supply Res. Council*), **The International Geophysical Year 1957–58.** *Institution of Electrical Engineers, London, Proceedings, Pt. B*, 106(29):437–443, Sept. **1959.** fig., table. **DLC** -A lecture on IGY (1957/58) delivered before the Institution of Electrical Engineers on April 23, 1959. Following the introductory remarks about IGY the paper concentrates on the actual program undertaken by IGY. This program may be regarded as falling into three broad categories: 1) phenomena in the atmosphere of earth and sun—solar activity, meteorology, the ionosphere, geomagnetism, aurora and airglow, cosmic rays; 2) investigation of the earth's surface—oceanography, glaciology, precise measures of latitude and longitude; 3) investigation of the earth's interior—earthquakes, gravity measurements. The paper first gives some general information about the organization of this program. It includes tabulation of stations in each of the 13 disciplines, the total cost of projects and the collection of observed data at world data centers. Later, observations made in each field are mentioned, drawing attention to the outstanding new concepts which have already been established or appear to have a considerable probability of being true. Finally, reference is made to the agreements of continued international geophysical cooperation in the future. *Subject Heading:* **1. IGY program.**—*I.S.* Ⓢ

11.10–14 525.2:551.5:550.3:551.46

Chapman, Sydney, **The earth and its environment.** *Institute of Radio Engineers, N. Y., Proceedings*, 47(2):137–141, Feb. **1959. DLC**—The IGY observations of the earth were related to all its parts, core, crust, oceans, and atmosphere. The sun, the dominant feature in the earth's environment, has been observed more fully and with greater continuity than ever before. The moon's position in the sky has been intensively measured for geodetic reasons. Meteors, observed both visually and by radio, will tell us much about the upper atmosphere. The satellites have revealed new features of the region above the *F* layer. The sun's atmosphere envelopes the earth and is extremely hot. The heat conducted from it

warms the earth's outermost atmosphere and helps to extend it, perhaps to half the distance to the moon. *Subject Heading:* **1. IGY program.**—*Author's abstract.* Ⓢ

11.10–15 551.506.22(09)

Chapman, Sydney, **IGY: year of discovery.** Ann Arbor, University of Michigan Press, **1959.** 111 p. figs., numerous photos. **DWB** (551.06C466ig)—A popular, highly graphic account of the IGY by one of the main participants. The various chapters deal with: 1) the earth and oceans, 2) the solid and liquid earth, 3) the atmosphere, 4) ionosphere, 5) cosmic rays, sun and nuclear radiation, 6) growth of natural science, and 7) the IGY. Equipment, activities (such as the South Pole station), radiotelescopes, mountain stations, maps of distribution of stations, high level balloon launchings, rockets, etc. are among the vivid illustrations. The history as well as the activities through 1958 are encompassed. *Subject Headings:* **1. International Geophysical Year, 1957–1958 2. IGY history.**—*M.R.* Ⓢ

11.10–16 551.506.22 551.5:550.3(437)

Chekhoslovatskaia programma rabot v Mezhdunarodnoĭ Geofizicheskoĭ Kooperatsii 1959 g. [Czechoslovak programme of International Geophysical Cooperation 1959.] *Studia Geophysica et Geodaetica*, Prague, 3(2):203–212, **1959.** In Russian and English. **DWB**—The proposed activities are listed under the following headings: world days, meteorology, geomagnetism, aurora and airglow, ionosphere, solar activity, cosmic rays, latitudes and longitudes, rockets and satellites, seismology, gravimetry, nuclear radiation, etc. No research will be carried out in glaciology and oceanography during this period. *Subject Heading:* **1. Czechoslovak participation in IGC.**—*I.S.* Ⓢ

11.10–17 551.506.22:551.521.12(596/599)

Paszyński, Janusz (*Inst. Geograf. PAN—Warsaw*), **Aktynometria w ramach polskiej wyprawy MRG 1957/1958 do Wietnamu.** [Actinometry in the research work of the Polish Expedition to Vietnam, IGY 1957/58.] *Acta Geophysica Polonica*, Warsaw, 7(2):230–236, **1959.** 4 figs. English summary p. 236. **DWB, DLC**—The paper informs about radiation research conducted by the Polish I.G.Y. Expedition to Vietnam. Two actinometric stations were installed, one at the Vietnamese-Polish Observatory Phu-lien in the Red River delta ($\phi = 20.8°$N, $\lambda = 106.6°$E, $h = 115$ m.a.s.l.) the other at the Meteorologic Station at Sa-Pa in the northwestern mountainous part of the country ($\phi = 22.3°$N, $\lambda = 103.8°$E, $h = 1570$ m.a.s.l.). At both these points the following observations were made: records of global and diffuse radiation, using Moll-Gorczynski solarigraphs, records of duration of sunshine by means of Campbell-Stokes and Jordan heliographs, and systematic measurements (every half hour or hour) of intensity of direct solar radiation by means of thermoelectric Moll-Gorczynski actinometers and a bimetal Michelson-Marten actinometer. The latter measurements were made both within the full range of the spectrum and in certain spectral regions, using standard colour filters OG 1, RG 2, RG 8. Systematic measurements of the intensity of the short-wave radiation reflected on surfaces of various type were also made using a Moll-Gorczynski solarimeter. Sporadic measurements of long-wave radiation were made by means of an Angstrom pyrgeometer. In this way the hourly and diurnal amounts of the shortwave-radiation falling on a horizontal surface were obtained—global, diffuse and direct, also the hours of bright sunshine and the instantaneous intensity values of direct solar radiation on a perpendicular surface and albedo values for various kinds of natural surfaces. These data can serve for comparison of radiation conditions in physiographically different parts of Vietnam. They form also a basis for research on transparency of the atmosphere with consideration of single spectral parts, which—by taking also into account aerological results—allows to determine the contribution of the individual factors to atmospheric extinction, i.e. selective absorption due to water vapor and scattering by suspended particles. Special attention was given to the problem of correlation between global insolation and duration of sunshine. Measurements of direct solar radiation in different spectral regions were made twice during the voyage on the route Baltic-Atlantic-Indian Ocean-South China Sea, once around Africa and once through the Suez Canal. *Subject Headings:* **1. Solar radiation measurements 2. Albedo data 3. Atmospheric extinction 4. Polish Expedition to Vietnam, IGY 1957/58 5. Vietnam.**—*Author's abstract.* Ⓢ

11.10–18 551.506.22

Shapley, Allan H., **The day-to-day coordination of IGY observations.** *Institute of Radio Engineers, N. Y., Proceedings*, 47(2):232–327, Feb. **1959.** fig., table, ref. **DLC**—The IGY World Days and Communications program has four facets: 1) an IGY Calendar of selected days for experiments which cannot be carried on continuously; 2) a scheme for specifying hours in advance; 3) the prompt and wide distribution of summary observations of outstanding solar and geophysical events; and 4) the use of the world-wide scientific communications network for processing information of temporal interest. This is a cooperative effort including all the countries participating in the IGY. The paper describes the plan and its execution, including the arrangements for rapid communications. *Subject Heading:* **1. IGY data control.**—*Author's abstract.* Ⓢ

11.10–19 551.506.22 551.524.7:551.510.53(98,99)

McClain, E. Paul (*Weather Forecasting Research Center*), **The thermal field of the Arctic stratosphere near 80°W in January.** Chicago. Univ. Dept. of Meteorology, Contract AF 19(604)-2179, Scientific Report No. 11, Sept. **1959.** 20 p. fig., 9 tables, 18 refs. **DWB.** Also included in its Final Report, Feb. **1960.** Ch. N.—Revised means, frequency distributions and other statistics based on ten years of January temperature observations at the 200, 100 and 50-mb levels are presented for four Arctic stations. The frequency distributions are shown to be markedly bimodal, a characteristic which becomes more pronounced with increasing height and latitude. Thermal conditions in the Arctic and Antarctic stratospheres are compared with the aid of recent IGY data. *Subject Headings:* **1. Arctic stratospheric temperature 2. Arctic.**—*Author's abstract.* Ⓢ

8. CONFERENCES

See also: **Planetary cosmogony** (Safronov), 11.10–100.

11.10–20 532.5:623.8(08)

U. S. Office of Naval Research, **Symposium on naval hydrodynamics, sponsored by the Office of Naval Research and the National Academy of Sciences—National Research Council, Sept. 24–28, 1956, Wash., D. C.** *National Research Council, Wash., D. C., Publication* No. 515, **1957.** 443 p. numerous figs., tables, refs. and eqs. **DLC** (QA927.U5 1956). Review by R. E. Street in *Physics Today*, N. Y., 12(5):56, May **1959.** **DLC**—There are few disciplines having the far-reaching and intimate consequences in the whole spectrum of Navy Operations as does hydrodynamics. As a result there is a need for meetings devoted exclusively to the different aspects of naval hydrodynamics. To meet this need and as one of the ways of fulfilling its mission of insuring maximum contribution of basic science to Naval effectiveness, the Office of Naval Research has developed a series of symposia of which these proceedings are the initial outcome in order to derive the greatest possible benefits for those both in research and in design. The following goals are sought in the several contributions—first, critical reviews of analyses of the status of each area including the results of important recent researches; second, an interpretation, where appropriate, of the significance of these results for future design applications; and finally, guidance for future research based on the author's conclusions and opinions regarding the most fruitful directions toward which future research might be oriented. The intimate role of the foundation and scientific aspects of the field in naval and marine applications is naturally revealed in the choice of topics finally selected for presentation. *Subject Headings:* **1. Naval hydrodynamics symposia. I. Sherman, F. S. II. National Research Council, Wash., D. C.**—*I.S.*

11.10–21 551.510.534:061.3

International Ozone Conference, Chicago, Nov. 1956, **Ozone chemistry and technology: proceedings of the conference.** Wash., D. C., American Chemical Society, March **1959.** 465 p. figs., photos, tables, refs., eqs. (*Advances in Chemistry Series*, No. 21.) Pertinent articles abstracted separately. **DWB** (M10.534 1614oz)—The International Ozone Conference, held in Chicago from Nov. 28 to 30, 1956 was the first occasion for an international exchange of information concerning ozone in both science and technology. The registrants

numbered 300; over sixty papers were submitted, and the conference was scheduled in triple concurrent sessions. The present book is a compilation of the 60 papers read during the conference. These papers present many facets of the science, technology and application of this versatile form of oxygen. *Subject Heading:* **1. Ozone conferences.**—*I.S.*

9. HISTORY—BIBLIOGRAPHY

See also: **Literature on radio studies of meteors** (Vincent, Smith), **11.10–110.**

11.10–22 551.506.3:551.58(436)(09)

Grammer, Martin, **Die Linzer Wetterbeobachtungen Johannes Keplers.** [Linz weather observations of Johannes Kepler.] *Wetter und Leben, Sonderheft*, Vienna, No. 6:47–86, **1959.** 4 figs., 11 tables. **DLC**—This is a translation of the complete Latin text of the marginal comments of KEPLER on the weather of Linz. The translation is from the seventh volume of the Latin complete works of KEPLER edited by Frisch (Astronomii Opera Omnia edidit Dr. Christian Frisch, 7 Vol., Frankfurt a.M., 1868). The weather descriptions referring to Linz are found under the title "Marginalia ex Ephemeridibus ad annos 1617–1636 on pages 618–620 and 625 to 643. The translated text presented in this article includes the following, viz: complete text of the marginal comments from the ephemeridae for the year 1617; and the daily weather observations of Kepler from the ephemeridae for the years 1617–1626. *Subject Headings:* **1. Historic weather records 2. Linz. I. Kepler, Johannes.**—*I.L.D.*

B. APPLICATIONS

1. AERONAUTICS

See also: **Aeronautical dictionary** (Adams), **11.10–12**; **Behavior in conventional and extra-terrestrial flight** (Stewart), **11.10–56.**

11.10–23 551.551.5

Arakawa, H. (*Meteor. Res. Inst., Tokyo*), **Possible criteria of an explanation of the phenomenon of clear-air turbulence encountered by aircraft.** *Papers in Meteorology and Geophysics*, Tokyo, 9(1):25–28, May **1958.** 2 figs., 10 refs., 4 eqs. Japanese summary p. 28. **DWB**—Investigation has shown that the clear-air turbulence encountered by aircraft appears to occur (1) below the jet isotach-max and on its north, or cyclonic, side; and (2) above the jet isotach-max and on its south, or anticyclonic, side. Through the use of two stability criteria given by the present author, one might hope to arrive at an explanation for the phenomenon of clear-air turbulence. *Subject Headings:* **1. Clear air turbulence 2. Turbulence theories.**—*Author's abstract.*

11.10–24 551.558.1:551.555.3:629.135.15

Kaufmann, P., **Aerologische Kennwerte für den Segelflug.** [Aerological criteria for gliding.] *Schweizer Aero-Revue*, Bern, 33(5):253–255, May **1958**; 33(6):318–319, June **1958** and 33(7):347–348, July **1958.** 3 figs., 17 eqs. **DLC**—The knowledge of the atmospheric elements is of great practical importance for gliders. The observations made during flight have to be controlled after landing. The author tries to coordinate the practices of gliding with the different representations (charts and drawings) used in meteorology. Follows a description of the different thermal types and of the associated clouds. Lee waves, föhn waves and air waves are treated. Very clear and remarkable examples are given and forecasts for gliding discussed. *Subject Headings:* **1. Gliding meteorology 2. Thermals 3. Lee waves.** —*A.V.*

11.10–25 629.135.1:551.551:551.558.1

Raspet, August (*Aerophysics Dept. Mississippi State Univ.*), **Some thoughts on new approaches to soaring.** *Schweizer Aero-Revue*, Bern, 35(2):118–121, Feb. **1960.** 1 fig., 4 refs. Also: **Comments by Paul B. MacCready,** p. 121. **DLC**—New sources are discussed of energy

which may be used to improve the glide ratio forty to one of sailplanes. The author treats especially of the extraction of solar energy by impinging of the sun on the upper surface of the wing and of extraction of energy from atmospheric turbulence. In his comments P. MACCREADY treats of some meteorological aspects of the problem and makes some suggestions: improving of the minimum sinking speed of the sailplane; creating upcurrents by cloud seeding with silver iodide or dry ice; creating a thermal and a cumulus cloud by dropping carbon black in still air. *Subject Headings:* **1. Soaring 2. Atmospheric turbulence energy 3. Thermals 4. Cloud seeding for updraft production.**—*A. V.*

2. ASTRONAUTICS

See also: **Artificial Earth Satellites** (Akad. Nauk SSSR), 11.10–11; **Solar batteries** (Daniel), 11.10–52; **Behavior in conventional and extraterrestrial flight** (Stewart), 11.10–56; **Medico-biological studies on rockets** (Akad. Nauk SSSR), 11.10–57; **Piercing at cosmic velocities** (Lavrent'ev), 11.10–117; **Micrometeorite impacts to 135 km** (Lovering), 11.10–118; **Meteorite pitting** (Williams), 11.10–119.

11.10–26 629.13/9(02)

Space Aeronautics Research and Development Hand Book, Vol. 3, 1959/1960, issued by Conover-Mast Publications, Inc., **1959.** Sec. A-L (each section repaged). figs., tables, refs. Price: $2.00 from Conover-Mast. **DWB**—A large paper-covered volume containing innumerable advertisements, as well as articles and data on systems engineering (U. S. and Soviet Space firings, U. S. test and Research Vehicles, etc.), research and development in dynamics and structures, propulsion, electronics, systems for space flight, electronics components, accessory systems, accessory components materials, production, engineering, testing and data processing, human factors and ground support. Equipment is well illustrated and useful operational data given in tables. *Subject Headings:* **1. Space aeronautics handbook.** —*M. R.* Ⓢ

11.10–27 551.507.362.2:629.19

Rosen, Milton W. (*Naval Res. Lab., Wash., D. C.*), **The satellite launching vehicle.** (In: Symposium on High Altitude and Satellite Rockets, Cranfield, England, July 1957, [**Proceedings**]. N. Y., Philosophical Library, **1959.** p. 15–22. 8 figs.) **DWB** (629.1388 S989hi)—The Vanguard satellite launching vehicle is a three-stage rocket of which the first two stages are guided and the third stage is rotated to control its orientation while it is firing. The first stage, an improved Viking, serves primarily to raise the remaining stages to altitude. The second stage, another liquid propellant rocket, contains the guidance for the three-stage vehicle and, in addition, supplies some of the propulsive energy. The third stage, a solid propellant rocket, is ejected from the second stage at orbital altitude and provides about half of the required orbital velocity. The basic requirements for the launching vehicle were established by the satellite payload and the desired orbit. These requirements led to the choice of a three-stage rocket with guidance in the second stage. The development programme is based on extensive ground testing of components and systems followed by a series of test vehicle flights. Finally, six satellite launching attempts are to be made during the International Geophysical Year. *Subject Headings:* **1. Satellite launching vehicles 2. Project Vanguard.**—*Author's abstract.* Ⓢ

11.10–28 629.19:539.08

Wolczek, O. S. (*Inst. for Nuclear Phys. Res., Warsaw, Poland*), **Künstliche Kernenergiequellen im kosmischen Raum.** [Artificial nuclear energy sources in cosmic space]. *International Astronautical Congress, Amsterdam, Aug. 1958, Proceedings of the 9th Congress,* Vol. 1, issued **1959.** p. 67–87. 4 figs., 2 tables, 16 refs., 2 eqs. English, German and French summaries. **DLC** (TL787.I44)—This paper deals with the question of the exploitation of nuclear energy for experimental purposes in cosmic space. Artificial sources of this energy—explosive and non-explosive—could serve studies concerning cosmic space proper by determining the matter present in it and by permitting the exploration of the properties of this matter. The mentioned sources would further permit a more definite exploration of such structures as

meteoritic swarms. In this paper it is proposed that special cosmic laboratories should be formed in which research in the field of experimental astrophysics on star models could be carried out with respect to artificial sources of nuclear energy. This kind of laboratory would be devoted to the study of a variety of subjects, from the practical exploitation of nuclear energy for the generation of electric energy on the Earth's surface to the problem of the occurrence of so-called anti-matter and its properties. *Subject Headings:* **1. Nuclear experiments in space 2. Cosmic nuclear energy 3. Astrophysical laboratories.**—*Author's abstract.* Ⓢ

11.10–29 541.124.7 537.567/58

Kash, S. W., **A comparison of ion and plasma propulsion.** *Institute of Radio Engineers, N. Y., Proceedings*, 48(4):458–465, April **1960.** 5 figs., 2 tables, 10 refs. **DLC**—Several important features and parameters of ion and plasma accelerators for propulsion are compared. Estimates for the thrust of individual ion and plasma acceleration units are given. Impulse measurements for a collinear electrode plasma accelerator are presented. The maximum thrust for an ion gun does not depend on the diameter of the beam, but primarily on the accelerating voltage. Because of the relatively small thrust of the ion accelerator, a greater number of them will be required for a given total amount of thrust. Estimates indicate that the ion accelerator may be somewhat more efficient; however, further experiments are needed to determine the efficiency of both types of accelerators. Beam neutralization is a problem peculiar to the ion accelerator. Considerable research and development may be necessary to provide a satisfactory method for neutralizing the ions. An estimate of the power for neutralization is made. The variation of efficiency with specific impulse is discussed. Further experiments are needed to determine the most efficient ranges of specific impulse for both types of accelerators. Erosion is a serious problem in electrical propulsion; however, for a plasma accelerator it may actually be utilized to provide the propellant material. *Subject Heading:* **1. Rocket propulsion.**—*Author's abstract.* Ⓢ

11.10–30 537.567.58:551.507.362.1

Kaufman, Harold R. (*Lewis Res. Cent. Cleveland, Ohio*), **One-dimensional analysis of ion rockets.** *U. S. National Aeronautics and Space Administration, Technical Note* D-261, March **1960.** 35 p. 3 figs., table, 12 refs., 59 eqs. **DWB, DLC**—A one-dimensional analysis was made of space-charge effects in ion and electron accelerators and the problems associated with mixing beams from such accelerators. The accelerate-decelerate principle was useful for maintaining high beam current densities of both electrons and ions. High electron velocities will tend to be a problem even with an accelerate-decelerate design. The effect of such excess electron velocity (above ion velocity) on the mixing or neutralization process is determined. *Subject Heading:* **1. Rocket propulsion.**—*Author's abstract.* Ⓢ

11.10–31 629.19:523.164.3/4

Franklin, K. G. and Birx, D. L., **A study of natural electromagnetic phenomena for space navigation.** *Institute of Radio Engineers, N. Y., Proceedings*, 48(4):532–541, April **1960.** 8 figs., 5 tables, 10 refs., 22 eqs. **DLC**—A study has been carried out for the United States Air Force investigating the use of natural electromagnetic radiation in the space environment for navigational purposes. Radiations from the sun, the stars, and interstellar space in both the visible and RF portions of the spectrum and also cosmic rays have been investigated. Emphasis has been placed on the measurement of velocity in space utilizing the Doppler phenomenon. Equipment and techniques useful in deriving velocity information from Doppler shift measurements are described and figures for expected accuracy are derived. Other passive techniques having possible application to space navigation such as the measurement of total solar radiation and solar diameter are briefly discussed. *Subject Headings:* **1. Electromagnetic radiation 2. Space flight.**—*Authors' abstract.* Ⓢ

11.10–32 629.19:551.510.536

Nonweiler, T. R. F., **Problems of interplanetary navigation and atmospheric re-entry.** *Royal Aeronautical Society, Journal*, 64(591):155–160, March **1960.** 9 figs. **DWB**—The author surveys the problems connected with the aerodynamics of re-entry as they affect either purely earth-bound or space vehicles; especially as they are affected by the trajectory

the vehicles are designed to follow, or may find themselves upon due to some error of navigation. The problems discussed are those primarily concerned with retardation and heat transfer. Numerous graphical representations illustrate the discussion. *Subject Headings:* **1. Space flight 2. Re-entry into atmosphere.**—*I.S.* Ⓢ

11.10–33 525.14:521.21:551.507.362.2

Proskurin, V. F. and Batrakov, Iu. V., **Vozmushcheniia pervogo poriadka v dvizhenii iskusstvennykh sputnikov, vyzyvaemye szhatiem Zemli.** [First order perturbations in the motion of artificial satellites caused by oblateness of the earth.] *Iskusstvennye Sputniki Zemli*, Moscow, No. 3:32–38, **1959.** 2 refs., 15 eqs. **DLC, DWB.** Summary in the *U. S. National Aeronautics and Space Administration, Technical Translation*, F-8:3, **1960.** Complete transl. to be issued in same **Technical Translation** series.—The problem of the motion of a satellite in the field of attraction of an oblate planet is examined on the assumption that the satellite's orbital plane can have any inclination to the plane of the equator of the planet. It is also assumed that the planet has the form of an ellipsoid of rotation and that the oblateness of the planet is rather small. As a result of this in the expansion of the perturbation function in terms of powers of the oblateness, it is possible to restrict the expansion to terms containing the first power of the oblateness. The portion of the perturbation function being considered is expanded in a series of powers of the eccentricity; coefficients of the series are very simply expressed by trigonometric functions of the angle of inclination. Integration of ordinary Lagrange equations gives an analytical expression of the first order perturbations relative to the oblateness of all of the elements of the orbit with an accuracy up to the fourth degree of the eccentricity inclusively. *Subject Headings:* **1. Satellite orbits 2. Perturbation equations.** —*Author's abstract.* Ⓢ

11.10–34 551.507.362.2

Vakhnin, V. M. and Beletskiĭ, V. V., **O nabliudenii za iskusstvennym sputnikom po metodu ozhidaniia.** [Observation of artificial satellites by the expectation method.] *Iskusstvennye Sputniki Zemli*, Moscow, No. 3:47–53, **1959. DLC, DWB.** 5 figs., ref., 5 eqs. Summary in *U. S. National Aeronautics and Space Administration, Technical Translations*, F-8:4, April **1960.** Complete transl. to be issued in same **Technical Translation** series.—A method is proposed which permits making repeated observations of a once observed satellite if its orbital period is unknown. Proposed initially, is that the orbital inclination, the longitude of the node, and the location of the perigee are constant. This holds true sufficiently well for orbits which are close to circular polar orbits. In this case, it was felt possible to formulate the following "rule of local time": "if the inclination of the orbit of a satellite is not equal to zero, then the intersection of any given latitude by the satellite will always occur at one and the same local star time." This rule continues to function even if the period of revolution, eccentricity, or position of the perigee changes. For example, with a change in the period of revolution, the point of intersection is shifted, but the time of intersection, calculated for local time, has the same value in the new point as it had in any other in which the satellite crossed this same latitude. The rule is not considered accurate for a real orbit in which exists precession of the plane of the orbit and the motion of the perigee in the plane of the orbit, and can be applied only for small intervals of time and for observations with a sufficiently wide angle of view. However, an "expectation graph" can be calculated for orbits with changing orientation. Formulas for plotting the "expectation graph" for various sets of known data are given. It is essential that one variable factor, the rate of precession of the orbit, be taken into account for successful application of the method. *Subject Heading:* **1. Satellite observations.**—*Author's abstract.*

11.10–35 551.507.362.2:538.54

Wilson, Raymond H., Jr. (*Goddard Space Flight Center, NASA, Wash., D. C.*), **Magnetic damping of rotation of satellite 1958β2.** *Science*, Wash., D. C., 130(3378):791–793, Sept. **1959.** fig., 7 refs., 18 eqs. Also [Comment] by Lincoln La Paz and [Reply] by Wilson, *Ibid.*, 131(3397):355–360, Feb. 5, **1960.** 2 refs., 4 eqs. **DLC**—From over 200 observations of the decreasing spin rate of Vanguard I made during the year since its launching, eddy-current induction theory yields 0.115 ± 0.001 gauss as the mean magnetic field normal

to the spin axis of the satellite. This measured value agrees with that deduced from BAUER's model of the earth's dipole field. *Subject Headings:* **1. Satellite spin 2. Geomagnetic field components 3. Vanguard I.**—*Author's abstract.* Ⓢ

11.10–36 551.507.362.2:521.12

Musen, Peter (*Nat. Aeronautics and Space Admin., Silver Spring, Md.*), **Application of Hansen's theory to the motion of an artificial satellite in the gravitational field of the earth.** *Journal of Geophysical Research*, Wash., D. C., 64(12):2271–2279, Dec. **1959.** 6 refs., 43 eqs. **DLC**—In order to draw geophysical and geodetic conclusions from the motion of the artificial satellite, we need an accurate theory that will permit the easy inclusion of any gravitational term. This article contains a theory of Hansen's type adaptable to the use of large computing machines. The form of the disturbing function suggests the use of the process of iteration. The computations can be carried out to any desired order compatible with the accuracy of the geodetic parameters. The theory as written is valid for zonal harmonics of all orders in the earth's gravitational field. A program based on this theory was developed by Dr. Herget and his collaborators and was used by the Vanguard Computing Center to produce the numerical theories of several satellites. *Subject Heading:* **1. Satellite motion.**—*Author's abstract.* Ⓢ

11.10–37 551.507.362.2:521.6:521.44

El'iasberg, P. E., **Zavisimost' vekovykh izmenenii elementov orbit ot soprotivleniia vozdukha.** [Dependence of secular variations in orbital elements on air resistance.] *Iskusstvennye Sputniki Zemli*, Moscow, No. 3:54–60, **1959.** 2 figs., 4 eqs. **DLC, DWB.** Summary in *U. S. National Aeronautics and Space Administration, Technical Translations*, F-8:5, April **1960.** Complete transl. to be issued in same **Technical Translation** series.—The effect of air resistance on secular variations in the orbit elements of artificial earth satellites has been considered in three earlier papers by I. M. IATSUNSKIĬ; D. E. OKHOTSIMSKIĬ; T. M. ENEEV; and G. P. TARATYNOVA; all of which appeared in *Uspekhi Fizicheskikh Nauk*, Vol. 63, no. 1a, **1957.** The present work is the development of an idea advanced in the first of these papers. The idea concerns the series expansion of the secular variations in the orbit elements in terms of Bessel functions of an imaginary argument. This technique produces simple descriptive formulas which can be used to solve a number of problems, such as determining the dependence of secular variations in orbit elements on the magnitude of these elements and evaluating the accuracy of air density determinations on the basis of measurements of the secular variations in the orbit elements. Analytical expressions are obtained for changes caused by air resistance in the latus rectum of the orbit, the eccentricity, the major semiaxis, the period of revolution, and the distance from the perigee to the center of the earth. It is assumed that air density is a function of altitude alone. The error in the formulas resulting from various approximations made for the sake of simplicity is 1 to 2 percent when the eccentricity is greater than 0.04, increases to 6 percent when the eccentricity is 0.023, and continues to rise for smaller eccentricities. It is further shown that the rate of increase in air density with altitude is a function of only two orbit parameters, the period of revolution and the distance from the perigee to the center of the earth. *Subject Headings:* **1. Satellite orbits 2. Air density effects on satellites.**—*Author's abstract.* Ⓢ

11.10–38 929.19:521.1

Cap, Ferdinand (*Univ. Innsbruck, Austria*), **Die Anwendung der Gröbnerschen Methode zur Lösung von Differentialgleichungen auf das astronautische n-Körper-Problem.** [Applications of the Gröbner Method for the solution of differential equations of the n-body problem.] *International Astronautical Congress, Amsterdam, Aug. 1958, Proceedings of the 9th Congress*, Vol. 1, issued **1959.** p. 62–66. 2 refs., 26 eqs. English, German and French summaries. **DLC** (TL787.I44)—With the help of the Lie series, Gröbner discovered a new and extremely powerful method for the integration of differential equations. It consists of constructing, from a differential equations system, an operator with the aid of which the solution is presented as an image of the limiting conditions. The new method is extensively discussed and its application to the n-body problem in astronomy and astronautics should furnish the complete solution. *Subject Headings:* **1. Astronautics 2. n-body problem.**—*Author's abstract.* Ⓢ

11.10–39 523.4:629.19

Magness, T. A.; McGuire, J. B. and Smith, O. K. (*all, Space Tech. Lab., Los Angeles, Calif.*), **Accuracy requirement for interplanetary ballistic trajectories.** *International Astronautical Congress, Amsterdam, Aug. 1958, Proceedings of the 9th Congress*, Vol. 1, issued **1959.** p. 286 306. 16 figs., 3 tables, 5 refs., 37 eqs. English, German and French summaries. **DLC** (TL787.144)—This paper examines guidance requirements for a variety of interplanetary trajectories. Emphasis is on Earth-Mars and Earth-Venus shots, but the methods used apply, in general, to transfer ellipses from one satellite to another in a central gravitational field. Previous investigations have concentrated on minimum energy trajectories, which involve large ballistic error coefficients. The present analysis shows that error coefficients depend critically upon the choice of nominal trajectory and may be improved by factors of ten and more over minimum energy values. An approximate analytical model involving the following assumptions is utilized in the calculations: 1) The "*n*-body problem" may be approximated by a sequency of two-body problems. 2) The earth and the target planet rotate about a fixed sun in circular orbits. 3) The orbits of the earth and the target planet are coplanar. The method used for deriving guidance requirements is first to study elliptical trajectories connecting two moving points of infinitesimal mass travelling in circular satellite orbits about the sun. These trajectories are then perturbed by errors in initial (or burnout) conditions, and the misses due to these perturbations are calculated by examining the first derivative of the distance of closest approach with respect to burnout parameters. A trajectory for which one or more of these derivatives, or miss coefficients, vanishes is called a "guidance minimum" trajectory. On such a trajectory, the permissible errors in burnout parameters are many times greater than for most other trajectories. The chief aim of the paper has been to estimate the orders of magnitude of the various miss coefficients and to establish the existence of guidance minimum trajectories. The analysis techniques used are not exact for an *n*-body problem, and the limitations thus imposed on the results are discussed. *Subject Headings:* **1. Interplanetary trajectories 2. n-body problem.**—*Authors' abstract.* Ⓢ

11.10–40 551.507.362.2:621.398

Brockman, M. H.; Buchanan, H. R.; Choate, R. L. et al. **Extraterrestrial radio tracking and communication.** *Institute of Radio Engineers, N. Y., Proceedings*, 48(4):643–654, April **1960.** 10 figs., 5 tables, 11 refs., numerous eqs. **DLC**—When the U. S. Army lunar program was initiated in 1958, the Jet Propulsion Laboratory (JPL) was assigned the responsibility for the upper rocket stages and the payload. Payload responsibility included radio tracking and communication with the lunar probe. JPL's Microlock system, used for communicating with the early Explorer satellites, did not have sufficient range to perform this mission. Therefore, a new radio system designated TRACE(E) (TRacking And Communication, Extra-terrestrial) was designed. To the best knowledge of the authors, the TRACE(E) system is the first deep-space communication link to provide accurate tracking and telemetry data at lunar distances. The design principles of the TRACE(E) system are presented in this paper in conjunction with a description of the equipment and actual performance data taken during the Pioneer IV lunar mission in March 1959. The TRACE(E) system is an integral part of the NASA/JPL radio tracking station located near Goldstone Lake north of Barstow, Calif. Future plans for improving the performance of the TRACE(E) system are indicated. *Subject Headings:* **1. Satellite tracking 2. TRACE(E) (TRacking And Communication, Extra-terrestrial) system. I. Malling, L. R.**—*Authors' abstract.* Ⓢ

11.10–41 551.501.8:551.507.362.2

Englische Beobachtungen an den beiden Russischen Erdsatelliten. [English observations on the two Russian satellites.] *Naturwissenschaftliche Rundschau*, Stuttgart, 11(3):102–103, March **1958. DWB, DLC**—England was particularly well equipped with radio direction finder, radio telescopes and radar facilities to track the first Russian satellite, especially since the angle of inclination of its path exceeded 60°. For the purpose of obtaining more exact data on the shape of the earth, radar methods are not suitable. The Royal Air Force Establishment will, therefore, use a kinetheodolite which measures time with a precision of a thousandth of a second and space with an accuracy of 30 arc seconds. It was possible to determine that the sputniks encountered an electrical resistance in the F layer in addition to the slight air

resistance. The low sending frequency of 20 to 40 Mega Herz was particularly advantageous because of its sensitivity to ionospheric influences. The rotation velocity about its axis was found to be 7/sec. Satellite 1957 α_2 had a brightness of 6 magnitudes. The rocket shell had a brightness of -1 magnitude. The size of the reflecting surface of 1957 α_2 and α_1 was determined with radar. The small satellite had an area of 0.5 m² with a diameter of 1.20 m. The rocket shell has a surface of 10 m². *Subject Headings:* **1. Radio satellite observations 2. Satellite tracking 3. Soviet satellites.**—*I.L.D.*

11.10–42 551.507.362.2:521.6:531.56

Cheatham, Donald C.; Young, John W. and Eggleston, John M. (*all Langley Research Center, Langley Field, Va.*), **Variation and control of range traveled in the atmosphere by a high-drag variable-lift entry vehicle.** *U. S. National Aeronautics and Space Administration, Technical Note* D-230, March **1960.** 41 p. 16 figs., 4 refs., 23 eqs. **DWB** (629.1308.U585tn) —A study has been made of the variation of range traveled during the atmospheric entry phase of a high-drag variable-lift type of entry vehicle. The effect on range of such factors as entry angle, angle of attack, wing loading, initial velocity, orbital heading, and initial latitude was investigated. The data are presented in the form of charts showing the effect of each variable for entries starting at velocities close to circular satellite velocity. By using such a method, the range that will be traveled during the entry of a particular vehicle can be predicted for any combination of entry angle, wing loading, angle of attack, orbital heading, and initial latitude within the range covered by the analysis. Variations in range with variations in initial velocity can be accounted for during nonlifting entries. However, for lifting entries the variation in range with initial velocity is nonlinear and is difficult to predict. Results are also presented which show the feasibility of an automatic control which regulates angle of attack in such a manner as to control the trajectory of the vehicle to a desired landing area. This method of range control involves the concept of controlling the vehicle's trajectory to a reference trajectory which terminates at the desired landing area. Results using this method of range control show that the range could be controlled to within ± 20 miles of the desired location by the time an altitude of 100,000 feet is reached. *Subject Heading:* **1. Satellite reentry.**—*Authors' abstract.* Ⓢ

11.10–43 551.507.362.1:551.521.17:535.23

Hinteregger, H. E. and Damon, K. R. (*both, Air Force Res. Center, Bedford, Mass.*) and Hall, L. A. (*Comstock and Wescott, Inc. Cambridge, Mass.*), **Analysis of photoelectrons from solar extreme ultraviolet.** *Journal of Geophysical Research*, Wash., D. C., 64(8):961–969, Aug. **1959.** 8 figs., table, 10 refs. **DLC**—The first rocket experiment for analysis of photoelectrons from a metal surface exposed to solar extreme ultraviolet around 115 miles altitude is evaluated. The soundness of the experimental techniques is confirmed, and the first data on photoelectron energy distribution are presented. Details on the simplified 'photoelectric method' of radiation analysis are discussed, and the preliminary results of applying this method to the first flight data are given. *Subject Headings:* **1. Ultraviolet radiation measurement techniques 2. Rocket radiation measurements.**—*Authors' abstract.* Ⓢ

11.10–44 551.508:551.507.362.2

Imianitov, I. M. and Shvarts, Ia. M., **Metody bor'by s meshaiushchimi tokami, vozniakaiushchimi na vkhode elektrostaticheskogo fliuksmetra pri ego rabote v provodiaschcheĭ srede.** [Methods for the control of interfering currents originating at the input of an electrostatic fluxmeter during its operation in a conducting medium.] *Iskusstvennye Sputniki Zemli*, Moscow, No. 3:77–83, **1959.** 6 figs., 4 refs., 8 eqs. **DLC, DWB.** Summary in *U. S. National Aeronautics and Space Administration, Technical Translation*, F-8:7–8, April **1960.** Complete transl., *Ibid.*, F-16, May **1960.** 9 p.—Several methods are discussed. One method uses a synchronous detector at the output of the measuring circuit. Another method involves designing the measuring and screening plates so as to decrease both the modulation of flow of charged particles and the absolute value of current falling on the surface of the measuring plate. Experiments are included to show how this may be accomplished. A third method suggests use of negative feedback on the noise voltage. *Subject Headings:* **1. Electrostatic fluxmeters 2. Satellite instrumentation.**—*Authors' abstract.* Ⓢ

11.10–45 551.521.1:551.507.362.2

Naumann, Helmut (*Munich*), **Die Oberflächengestaltung künstlicher Himmelskörper.** [Surface finish of artificial celestial bodies.] *Naturwissenschaftliche Rundschau*, Stuttgart, 11(1):8–9, Jan. **1958.** eqs. **DWB, DLC**—A discussion of the characteristics of the surface of a satellite best suited for reflecting sunlight. The limiting surface is an ideal mirror closely approximated by pure steel aluminum and an ideal scattering white surface, such as artificial fiber enveloped with inlaid material. The satellite receives an equal amount of light from the sun and reflects it into space. If the satellite is spherical and reflecting, then from the point of geometrical optics, it acts like a convex mirror with a focus of $d/4$ (d=diameter). The author presents an equation for computing the brightness of the solar picture in the sphere, and discusses the appearance of the satellite when viewed sideways, the illumination intensity of a satellite with a diffuse scattering surface and heightening the appearance of a satellite by giving its surface the form of a polyhedron made out of many plane mirrors. *Subject Headings:* **1. Satellite radiation observations 2. Satellite sunlight reflection.**—*I.L.D.*

3. RADIO COMMUNICATION

See also: **Extraterrestrial radio tracking and communication** (Brockman et al.), 11.10–40; **Sortwave fadeouts without flares** (DeMastus, Wood), 11.10–75; **Air motions at meteoric heights** (Manning), 11.10–109; **Literature on radio studies of meteors** (Vincent, Smith), 11.10–110; **Oblique reflections from meteor trails** (Bain), 11.10–111; **Booker's theory of meteoric reflections** (Manning, Eshleman), 11.10–112; **Meteor echoes in forward scatter propagation** (Hagfors, Landmark), 11.10–113; **Observations of Geminid meteor stream** (Weiss), 11.10–114; **Narrow-beam radio equipment in detection of meteor showers** (Weiss), 11.10–115; **Echoing points of meteor trails** (Weiss), 11.10–116; **Ionospheric polarization** (Carlson), 11.10–143; **Gyro splitting of ionospheric echoes** (Ellis), 11.10–144; **Persistence of purely longitudinal or transverse propagation** (Hoffman), 11.10–151; **Abnormalities in foF2 during high solar activity** (Huang), 11.10–152; **Ionospheric cross modulation at standard frequencies** (Koch), 11.10–153; **Group refractive index of ionosphere** (Murty, Khastgir), 11.10–155; **Polarization of downcoming radio waves** (Murty), 11.10–156; **High-frequency anti-multipath investigation** (Silberstein), 11.10–159; **Radio noise from auroras** (Dowden), 11.10–167; **Sub-visual aurora and radio noise bursts** (Duncan, Ellis), 11.10–168; **Radio reflections from auroras** (Forsyth), 11.10–170; **Propagation over long paths crossing the auroral, temperate and equatorial zones** (Yeh, Villard), 11.10–188; **Path combinations in whistler echoes** (Morgan et al.), 11.10–211; **Ionospheric thermal radiation at radio-frequencies** (Dowden), 11.10–324.

11.10–46 551.5:621.396

Mismé, P., **Some notes on radiometeorology.** *World Meteorological Organization, WMO Bulletin*, 9(2):81–84, April **1960.** 3 refs. **DWB**—Article gives an account of the efforts made in the field of radiometeorology. Efforts are being made to improve the accuracy of radiosoundings. There is a need to get more information of certain atmospheric fluctuations. Refraction can produce curvature in an electromagnetic wave. This phenomenon can be observed on radar. It can be used by simple computation to determine the mean distribution of the decrease in atmospheric humidity. The field of radiometeorology is very wide. In years to come the chances of cooperation between meteorologists and engineers will be more than ever. *Subject Heading:* **1. Radio meteorology.**—*A.H.K.*

11.10–47 [551.510.62:523.74

Lauter, E. A. and Třiska, P., **Zur Deutung der plötzlichen Feldanomalien im Langwellenbereich bei Sonneneruptionseffekten.** [Interpretation of sudden field anomalies in long wave communication due to solar eruption effects.] *Zeitschrift für Meteorologie*, Berlin, 13(7/8):190–192, July/Aug. **1959.** 3 figs., 2 refs. **DWB, DLC**—The basic characteristics of the phenomenon are described as due to phase alterations between surface and space waves caused by sinking of the reflection level as shown by simultaneous measurement at the observatory Kühlungsborn and at the Geophys. Inst., Czechoslovak Acad. of Sc. at Prague, of transmissions from Brasow, at a distance of 1360 km. The analysis of the apparent height alterations on the basis of an equation of geometric-optical extension between surface and space waves

proved the existence of a solar eruption effect in the low ionosphere as well as the variations of the apparent reflection level. These and some other results of the analysis are illustrated by diagrams of recordings of electric field strength height variations of the apparent reflection level; of the analysis of the apparent reflection level associated with stronger solar eruption effects; and of the distribution of characteristic parameters of solar eruption effects. *Subject Headings:* **1. Solar eruption effects on radio communication 2. Radio field strength during solar eruptions 3. Longwave radio disturbances.**—*O.T.* Ⓢ

11.10–48 551.510.62:621.396.1

Janes, H. B.; Stroud, J. C. and Decker, M. T., **An analysis of propagation measurements made at 418 megacycles per second well beyond the radio horizon (a digest).** *U. S. National Bureau of Standards, Journal of Research, Sec. D (Radio Propagation)*, 64(3):255–257, May/June **1960.** 2 figs., 3 refs. **DWB, DLC**—During an 18-month period in 1952 and 1953, transmission loss measurements at 418 megacycles were made over a 134-mile path between Cedar Rapids, Iowa, and Quincy, Illinois. Continuous recordings made simultaneously at several receiving antenna heights from 30 to 665 feet yielded information on diurnal and seasonal variations in both the hourly median basic transmission loss and in height gain. These data are compared to predictions made using the method developed by RICE, LONGLEY, and NORTON and are found to be in good agreement, particularly at the lower antenna heights. An analysis of the correlation of short-term signal level variations observed at horizontally and vertically spaced antennas is described. (Digest of *NBS Technical Note*, No. 6.) *Subject Headings:* **1. Radio wave propagation beyond the horizon 2. Cedar Rapids, Iowa 3. Quincy, Ill.**—*Authors' abstract.*

11.10–49 551.510.62:621.396.1

Ikegami, F. (*Nippon Telegraph and Telephone Corp.*), **A preliminary study of radio-meteorological effects on beyond-horizon propagation.** *U. S. National Bureau of Standards, Journal of Research, Sec. D (Radio Propagation)*, 64(3):239–246, May/June **1960.** 11 figs., 13 refs., 3 eqs. **DWB, DLC**—A study was made of American and Japanese radiometeorological data in order to suggest the dominant factors in propagation beyond the horizon. The diurnal variability of radio field strengths seems to be sensitive to the crossover height of rays tangent to the radio horizon and disappears for crossover heights greater than about 500 meters. High hourly median field strengths were observed in Japan corresponding to the existence of a marked refractive index discontinuity layer in a common volume of two antenna beams. The results of these experiments suggest that laminar structures of the atmosphere play an important role in beyond-horizon radio propagation. *Subject Heading:* **1. Radio wave propagation beyond the horizon.**—*Author's abstract.*

11.10–50 523.164.3/4:621.396.029

Smith, Alex G., **Extraterrestrial noise as a factor in space communications.** *Institute of Radio Engineers, N. Y., Proceedings*, 48(4):593–599, April **1960.** 4 figs., 2 tables, 22 refs. **DLC**—Present-day refinements in communication systems make it appear that extra-terrestrial noise sources may establish a fundamental limitation on long-range communications. The various cosmic and solar system radio sources are considered with respect to their intensities, spectral distributions, and temporal characteristics. The most severe forms of interference occur in the long-wave-length regions of the radio-frequency spectrum, so that the future of space communications probably lies in the perfecting of low-noise microwave systems. *Subject Headings:* **1. Space communication 2. Radio noise.**—*Author's abstract.* Ⓢ

11.10–51 538.69:621.396.1

Crombie, D. D. (*Dominion Physical Lab., New Zealand*), **On the mode theory of very-low-frequency propagation in the presence of a transverse magnetic field.** *U. S. National Bureau of Standards, Journal of Research, Sec. D (Radio Propagation)*, 64(3):265–267, May/June **1960.** 4 refs., 11 eqs. **DWB, DLC**—The effect of a purely transverse horizontal magnetic field on the propagation of very-low-frequency (VLF) waves is considered. It is shown that the magnetic field introduces nonreciprocity, and that for propagation along the magnetic equator, the rate of attenuation is less for west-to-east propagation than for east-to-west propagation. *Subject*

Headings: **1. Magnetic effects on radio propagation 2. VLF radio wave propagation through transverse magnetic field 3. Radio wave propagation theories.**—*Author's abstract.*. Ⓢ

4. INDUSTRY

See also: **Utilization of solar energy** (Schüepp), **11.10–307.**

11.10–52 551.521.1:621.47:551.507.362.2

Daniel, Arthur F., **Solar batteries.** *Institute of Radio Engineers, N. Y., Proceedings*, 48(4):636–641, April **1960.** 3 figs. (incl. photo), table, 17 refs. **DLC**—The introductory part of this paper provides a brief summary of how recent advances in military electronics for ground and space applications have created an urgent need for new energy sources and power supplies. In this search for new sources of power, considerable attention is being devoted to the utilization of solar energy. A short summary is provided of the applications of USASRDL-developed solar cells in the satellite field to date. This includes a discussion of the apparent reliability and efficiency of solar cells in operating situations and the environmental factors affecting solar cells. A brief discussion is given of the various methods of mounting solar cells with succinct comments on the advantages and disadvantages of different methods. Reference is also made to USASRDL quality control methods and the quality vs cost problem. The primary portion of the paper is devoted to a detailed discussion of those energy conversion devices which employ static methods for direct conversion of solar energy to electrical energy, i.e., those types which utilize the thermoelectric, Edison (thermionic emission), photovoltaic and photoemission effects. The relative merits of these systems based on present and anticipated conversion efficiencies are reviewed, in brief, for guidance as to future possibilities of these types of devices and their utilization in the satellite program. *Subject Headings:* **1. Solar batteries 2. Satellite instrumentation.**—*Author's abstract.* Ⓢ

11.10–53 551.521.1:621.352

Heeger, A. J. and Nisbet, T. R. (*both, Lockheed Missile Systems Div. Pao Alto, Calif.*), **The solar cell: conditions for optimum performance.** *Solar Energy*, Phoenix, Ariz., 3(1):12–18, Jan. **1959.** 14 figs., ref., 9 eqs. **DWB**—The role of the dark diodide curve in solar cell evaluation and circuit design is discussed. A simple graphical method of determining the optimum load resistance of any cell is developed using the diode curve as a basis. Detailed consideration of the diode curve offers insight into the operation of a solar cell, and the general conclusions are stated. The versatility of this method of approach is demonstrated by discussion of the conditions for optimum load when the intensity of illumination is varying. A simple, automatic device for displaying diode curves is described, with details of its use in the evaluation of solar cells. *Subject Heading:* **1. Solar batteries.**—*Authors' abstract.* Ⓢ

11.10–54 551.578.46:551.556:625.711

Friedrich, W. (*Vienna*), **Klimatische Betrachtungen zur Planung der Autobahnstrassen zwischen Wr. Neustadt und Oberwart.** [Climatic considerations in the planning of highways between Wr. Neustadt and Oberwart.] *Wetter und Leben*, Vienna, 11(1):11–14, **1959.** fig. German summary, p. 14. **DLC**—A comparison was made of the weather conditions along two possible courses for the planned Wr. Neustadt-Oberwart highway, namely the west highway through the Pittental across the Spitzerriegel to Oberwart and the east highway across Siegraben, Mittelburgenland, Schlaining and Oberwart. The latter is more favorably situated since it has less snow and hence fewer snowdrifts. Data on snow accumulation, duration of snow cover and wind velocity on both highways are presented in the text. *Subject Headings:* **1. Snow cover data 2. Wind velocity data 3. Highways 4. Austria.**—*I.L.D.*

11.10–55 771:551.585.9

Photographieren in feucht-tropischem Klima. [Photography in humid tropical climate.] *Naturwissenschaftliche Rundschau*, Stuttgart, 11(7):280, July **1958. DWB, DLC**—According to M. Rauschert (*Photographie und Wissenschaft*, v. 6, p. 6, 1957) it is now possible to photograph successfully in hot humid climates, provided certain precautions are taken: films must be packed air tight; the entire photographic equipment should be packed in small, air and

moisture tight metal boxes containing moisture absorbing substances. The camera should possess a very good objective, a reliable shutter and simple film loading. Many gadgets are unsuitable; small and medium sized picture cameras are most suitable. A reliable light meter is important especially for color photography. As protection against heat the packing cases must be kept in the shade, the metal cases can even be kept in water. *Subject Headings:* **1. Photographic equipment protection in hot humid climates 2. Hot humid climate photography 3. Tropical photography.**—*I.L.D.*

5. MEDICINE AND HEALTH

See also: **Biological effects of cosmic radiation** (Simons), 11.10–137; **Hygienic evaluation of microclimate of residential block** (Rudeĭko), 11.10–379.

11.10–56 551.507.362:613.693

Stewart, W. K. (*Inst. of Aviation Medicine, Royal A F, Farnborough*), **Behaviour in conventional and extra-terrestrial flight.** *Nature*, London, 184(4686):578–582, Aug. 22, **1959.** 47 refs. **DWB**—The future problems in aviation medicine are subtle and difficult. Many are concerned with the determination of behavioral responses to neurogenic stress in conditions where it is impossible to reproduce fully this stress on the ground. It would appear that studies on man should be supplemented by animal investigations and that a multi-disciplinary approach would enable adequate theories to be constructed on the relationships of alterations in perceptional learning to stress. With the verification of such theories or important parts of them, it should be possible to derive new selection processes for personnel involved in future flight or extra-terrestrial travel. *Subject Headings:* **1. Aviation medicine 2. Space medicine.** —*Author's abstract.* Ⓢ

11.10–57 551.507.362.1:574.6

Akademiia Nauk SSSR. Mezhduvedomstvennyĭ Komitet po Provedeniiu MGG, **Mediko-biologicheskie issledovaniia na raketakh.** [Medico-biological studies on rockets.] Its *Predvaritel'nye itogi nauchnykh issledovaniĭ . . . sputnikov Zemli i raket*, No. 1:109–149, **1958.** Galkin, A. M., et al: **Issledovaniia zhiznedeiatel'nosti zhivotnykh pri poletakh v germeticheskikh kabinakh raket do vysoty 212 km.** [Investigations on the vital functions of animals during flights in hermetically sealed rocket cabins to an altitude of 212 km.] p. 112–129. 12 figs., 5 tables. Engl. summary p. 129. Bugrov, B. G., et al.: **Issledovaniia zhiznedeiatel'nosti zhivotnykh pri poletakh v negermeticheskoĭ kabine raket do vysoty 110 km.** [Investigations on the vital functions of animals during flights in non-hermetically closed rocket cabins to an altitude of 110 km.] p. 130–149. 9 figs., 2 tables, 18 refs. Engl. summary p. 148–149. **DWB**—I. Dogs weighing 5–7 kg were used in the experimental studies and pulse rate, blood pressure by means of an oscillogram and respiration were measured, electrocardiograms were taken, and motion pictures of the animals were taken continuously during the flight. A pair of dogs was sent up in the rockets occasionally one was narcotized. Detailed physiological studies were made of the animals before and after the flight. The construction of the hermetically sealed climatic chamber, the injection, regeneration of air, the ventilation system, the apparatus for recording the parameters of the external environment (including the sheathing of the compartment, the heat insulating layer and barometric pressure in the cabin) and the physiological functions of the animals are described with the aid of diagrams and photographs. The physical factors acting upon the animal organisms during a rocket flight to heights of 100 to 212 km, the temperatures within the cabin and barometric pressure are discussed with the aid of data presented in tables and on a graph. The physiological responses show individual variations among the 14 dogs tested but all manifest a general pattern. During the active part of the flight when the load was directed from spine to chest the respiration rate was above the initial rate; during weightlessness the respiration rate declined to the initial level; in one animal the respiration rate declined during the period of load action. During the active period the pulse rate increased among all the animals: during weightlessness the heart rate declined to the initial level while undergoing considerable oscillations. At the end of weightlessness the pulse rates were at a minimum. In contrast to the non-narcotized animals the narcotized ones showed less change in respiratory and pulse rates and blood pressure during

flight. The greatest effect upon the physiology of the animals was manifested during the shift of the load and during braking. Weightlessness did not produce a marked disturbance in the functioning of the organism. The physiological changes recorded after the stoppage of the motor are not only the result of load shift but also the direct result of weightlessness and the gradual approach to control conditions is the result of partial adaptation. The change in pulse rate, respiration rate and blood pressure during weightlessness in the intact animals is a non-specific autonomic reaction to an unusual disturbance. II. The purpose of the study on vital functions in flights in a non-hermetically sealed cabin up to heights of 110 km was to determine the usefulness of a flying suit for maintaining life for approximately 1 hour at high altitudes, the possibility of leaving the cabin by catapulting during high velocity at heights of 80–90 km and the nature and degree of effect of specific flight factors during stay at higher atmospheric levels. The construction of the specially ventilated flying suit, the catapulting and parachuting system, the apparatus for measuring physiological responses and environmental conditions, the physical characteristics of flight conditions and the operation of the special safety equipment are described with the aid of photographs. During rocket flight the animals showed moderate changes in blood pressure, pulse and respiration rates. During the period of weightlessness the arterial pressure rose slightly in some instances but decreased in others. In most cases the pulse rate increased by 32–56 beats during the period of active flight; but in three cases if fell by 6–60 beats. In a number of instances the animals manifested a passive defensive reaction accompanied by involuntary urination and defecation. During the weightlessness there was no substantial change in the heart rate and ejection from the rocket was not accompanied as a rule by changes in heart rate. Further details of the physiological responses of the dogs are discussed with the aid of numerical data. *Subject Headings:* **1. Rocket research 2. Space flight physiology 3. Space medicine.**—*I.L.D.*

6. Radioactivity

See also: **Submicronic dust particles aloft** (Challande), 11.10–257; **Transport of radioactive particles in atmosphere** (Haarländer), 11.10–340.

11.10–58 551.577.7 551.510.41:546.02:539.16

Lal, D. (*Scripps Inst. of Oceanog., Univ. Calif.*); Rama, —, and Zutshi, P. K. (*both, Tata Inst. of Fundamental Res., Bombay, India*), **Radioisotopes P^{32}, Be^{7}, and S^{35} in the atmosphere.** *Journal of Geophysical Research*, Wash., D. C., 65(2):669–674, Feb. **1960.** fig., 3 tables, 8 refs., eq. **DLC**—The authors made simultaneous determinations of the concentrations of the radioisotopes P^{32}, Be^{7} and S^{35} in several rains collected at Bombay during the monsoon period of 1958. The observed annual deposition rates of P^{32} and Be^{7} are found to agree within the expected meteorological fluctuations, with those measured in the preceding two years at Bombay and other stations in India. S^{35} deposition, however, has varied significantly outside normal fluctuations. From the observed variations in the annual fallout of those isotopes during 1956–1958 and relative isotope concentrations in the individual rains, it has been concluded that nuclear weapons have not resulted in any appreciable contribution to the observed Be^{7} and P^{32} activities. However, S^{35} was contributed in appreciable quantities. During 1958, S^{35} concentrations were very large, amounting to as much as 35 per cent of the observed Sr^{89} concentrations in some rains. The relative concentrations of the isotopes Be^{7} and P^{32} in rains vary in a manner that would be expected for their production in the troposphere by cosmic rays, and their removal by wet precipitation with an average removal period of about 40 days. None of the rain samples analyzed so far could have resulted in precipitation occurring from an air mass which descended to the troposphere after an irradiation in the stratosphere for time periods that are long compared with the half-lives of the isotopes. *Subject Headings:* **1. Radioactive rainwater 2. Radioactive fallout data 3. Bombay, India.**—*Author's abstract.*

11.10–59 551.510.721:662.2:539.1(94)

Dwyer, L. J. (*Dir. Commonwealth Bur. Meteor.*); Martin, J. H. (*Phys. Dept. Cancer Inst. Board, Melbourne*) et al., **Radioactive fallout in Australia from operation Antler.** *Australian Journal of Science*, Sydney, 22(3):97–106, Sept. **1959.** 2 figs., 6 tables, 9 refs. **DLC**—"Antler" is the name given to the second series of weapon tests at the Maralinga Test Site in South-western South Australia, carried out during September and October, 1957. Three

atomic weapons were detonated, the first two on towers and the third suspended above the ground from balloons. The present paper reports fallout measurements in continental Australia obtained by sampling methods. Gummed paper was used to measure ground fallout at 85 stations; at some of these stations air and rainwater contamination were also monitored. Measurements were also carried out on sheep thyroids to ascertain that no untoward accumulation of radioisotopes in this tissue had occurred. The details of fallout measurements are discussed. The cloud trajectories for the three explosions, and the geographical distribution of the fallout sampling stations are graphically represented. The record of daily gummed film activities and of the whole body gamma-ray dose in milliroentgens, integrated to 50 years, for Rounds 1, 2 and 3 respectively, is tabulated in the appendix. *Subject Headings:* **1. Radioactive fallout data 2. Atom bomb tests 3. Australia. I. Stevens, D. J. II. Titterton, E. W.** —*I.S.*

11.10–60 551.551:551.510.7

Greenfield, Harvey, **Comparison of computed dosages for point and for cubical volume sources.** *U. S. Dugway Proving Ground, Utah, DPGRR*, No. 105, July 27, **1956.** 34 p. 3 figs., 6 refs., numerous eqs. **DWB**—Computed dosages for instantaneous point sources and cubical volume sources are compared. There is a wide variance in initial distribution curves, but the two curves approach each other in value as time passes. The volume source curves agree more closely with observed results. Discrepancies noted in previous Cloud Physics reports are partially explained. *Subject Headings:* **1. Turbulent diffusion of radioactive substances 2. Radioactive diffusion.**—*Author's abstract.*

7. AGRICULTURE

See: **Meteorology of air layer near ground** (Leningrad. GGO), **11.10–1.**

C. ASTRONOMY AND ASTROPHYSICS

1. YEARBOOKS

11.10–61 52 550.3 526 551.556:532.593 551.594 551.521.1/3

*France. Bureau des Longitudes. **Annuaire pour l'an 1959.** [Yearbook for 1959.] 551 p.+appendix. figs., charts, tables. Issued Paris, **1959. DLC**—This yearbook is subdivided into four parts. The first part is headed: forecasts for the year 1959; it contains information about the calendar, sun, moon, planets, eclipses of sun and moon, stars and tides. The second part treats of the earth. In particular, this chapter furnishes fundamental data on astronomic refraction, solar, atmospheric and terrestrial radiation, atmospheric electricity and terrestrial magnetism. The third part deals with astronomy and in the fourth part, headed: geographic and demographic data, a paragraph is devoted to swells and waves. In addition, this collection of fundamental data and general information on various geophysical and astronomical disciplines contains several notes, such as: the total solar eclipse of Feb. 15, 1961 (p. A1–8) and Modern calculation methods by J. KUNTZMAN (p. C1–9). An alphabetic index reminds of the subjects in the yearbooks for 1956 to 1959. This work, particularly intended for the general public may, owing to general information, numerous tables and numerical values, render service to geophysicists and astronomers. *Subject Headings:* **1. Astronomical meteorology 2. Astronomy yearbooks 3. Optical refraction 4. Atmospheric electricity 5. Radiation data.**—*A.V.* Ⓢ

2. INSTRUMENTS

See also: **Shutter for photographing solar disk** (Brekke), **11.10–92.**

11.10–62 522(47)

Seleshnikov, S. I., **Sovetskie astronomicheskie instrumenty.** [Soviet astronomical instruments.] *Priroda*, Moscow, No. 9:39–46, Sept. **1959.** 8 figs., **DLC**—An account of the

development of astronomical instruments in the U.S.S.R. since the October revolution is presented with the aid of photographs. The author describes apparatus for studying the sun, reflecting and minor-lens telescopes and astronometric apparatus such as zenith telescopes, photographic zenith tube, etc. *Subject Headings:* **1. Astronomical instruments 2. U.S.S.R.** —*I.L.D.* Ⓢ

11.10–63 523.87:535.33

Mertz, L. (*Harvard College Observatory and Smithsonian Astrophysical Observatory*), **Spectromètre stellaire multicanal.** [Multichannel stellar spectrometer.] *Journal de Physique et le Radium,* Paris, 19(3):233–236, March **1958.** 6 figs., 4 refs. French and English summaries p. 233. **DLC**—An interferometer has been built in order to apply FELLGETT'S technique to stellar spectrometry in the visible. Basically it consists of a variable retardation plate between polarizers; equivalently a section of a Lyot filter. The path difference can be varied by 175 λ at 4000 Å. In order to reduce scintillation noise one modulates the path difference at 3000 cycles per second with an electrooptic retardation plate; complete cancellation can be obtained by measuring the ratio of AC to DC. This interferometer used with the 24 inch Clark telescope easily differentiated colors and line structures of the Orion Nebula, and the comet Arend Roland as well as various types of stars. *Subject Headings:* **1. Stellar spectrometers 2. Fellgett's technique 3. Interferometers.**—*Author's abstract.*

11.10–64 535.243:535.853

Rogerson, John B., Jr.; Spitzer, Lyman, Jr. and Bahng, J. D. (*all, Princeton Univ. Observ.*), **A high-dispersion photoelectric spectrophotometer.** *Astrophysical Journal,* Chicago, 130(3): 991–1002, Nov. **1959.** fig., 4 tables, 19 refs., eq. **DWB, DLC**—Photoelectric equipment has been successfully used for high-dispersion spectrophotometry at the 100-inch telescope. The intensity in the spectrum was measured by the ratio of photon counts obtained by two photocells, one fixed, the other scanning the spectrum. Successful seeing compensation was achieved by using phototubes with a sensitivity that was relatively uniform spatially and by focusing a very small (1.3 mm) light-spot on the photocathode. With an exit slit 0.12 A wide, the intensity observed in repeated scans, with counts of 1 or 2 minutes' duration at each wave length, has a non-statistical fluctuation averaging 0.6% under good conditions; the fluctuation in the two channels separately amounts to about 8%. The statistical accuracy is limited by the low quantum efficiency of the telescope-spectroscope-photometer combination, with only one photon counted in every 5000 –a loss of 9.3 mag. A more efficient image slicer, a more sensitive phototube, and more careful attention to reflection losses could yield a gain of 3–4 mag. In ζ Per a search was made for the interstellar Al I lines at λ3944 A, with negative results. The equivalent width probably does not exceed 3 mA, about the value predicted by FIELD and MICHIE. Equivalent widths of the CH^+ line at λ4232.6 were measured in nine stars, with mean errors between 0.8 and 6 mA. For late-type stars the results are in general agreement with the BATES-SPITZER theory of circumstellar molecules; for early-type stars in equivalent widths differ by a factor of 6 for stars of the same color excess, although unreddened stars show no line. Measures of interstellar D lines were made to resolve the systematic difference of 30 per cent between Mount Wilson and Victoria results. The resultant equivalent widths agree with the earlier Mount Wilson determinations to within 2 per cent. *Subject Headings:* **1. Photoelectric spectrophotometers 2. Stellar spectra.**—*Authors' abstract.* Ⓢ

3. ASTROPHYSICS

See also: **Cosmic electrodynamics** (Dungey), **11.10–3.**

11.10–65 521.5

Newton, Robert R. (*Johns Hopkins Univ., Silver Spring, Md.*), **Periodic orbits of a planetoid passing close to two gravitating masses.** *Smithsonian Contributions to Astrophysics,* Wash., D. C., 3(7), **1959.** p. 69–75. 5 figs., table, 5 refs., 18 eqs. **DWB**—The periodic orbits that involve a close passage to two masses which move in circular orbits under their mutual gravitation and a third body, the planetoid, of negligible mass in the same plane, have been studied. These periodic orbits in the restricted three-body problem have been classified

according to the types of motion involved and methods are given for estimating the initial conditions for the various types or orbits. The report illustrates some sample orbits which have been determined by a digital computer. *Subject Headings:* **1. Planetoid orbits 2. Three-body problem.**—*N.N.* Ⓢ

11.10–66 523.852.22:523.87

Struve, O. and Zebergs, V. (*both, Berkeley Astronomical Dept., Univ. Calif.*), **The red satellite absorption spectrum of Beta Lyrae.** *Astrophysical Journal*, Chicago, 130(3):817–823, Nov. **1959.** 3 figs., 2 tables, 8 refs. **DWB, DLC**—The spectrum of the gaseous stream in β Lyrae which recedes from the observer immediately before primary mid-eclipse consists of absorption lines of H, He I, Ca I, Cr I, Fe I, Mg I, Mn I, Ni I, Al II, C II, [Ca II], Cr II, Fe II, Mg II, Mn II, Ni II, Sc II, Si II, Sr II, Ti II, and V II. The intensities of Fe I and Fe II indicate a stage of ionization intermediate between that of α Cygni and α Persei. The presence of strong He I satellite lines bears a resemblance to the spectrum of v Sagittarii. *Subject Heading:* **1. Stellar spectra.**—*Authors' abstract.* Ⓢ

11.10–67 523.852

de Vaucouleurs, Gerard (*Harvard College Obs.*), **Rotation and mass of the large magellanic cloud.** *Astrophysical Journal*, Chicago, 131(2):265–281, March **1960.** 7 figs., 7 tables, 40 refs., 9 eqs. **DWB, DLC**—New optical velocities of outlying nebulosities observed with the Mount Stromlo 74-inch reflector are used in conjunction with the old Lick velocities for a rediscussion of the rotation-curve and a revision of the mass estimate previously derived from the Sydney radio observations. If $m_0 - M = 19.0$ and $i = 63°$, the maximum rotational velocity is $V_r \simeq 145$ km/sec at $r \simeq 3.5$ kpc, and the revised mass is $\mathbf{M} = (2.5 \pm 0.6 \text{ p.e.}) \times 10^{10} \odot$; the absorption-free mass-luminosity ratio $\mathbf{M}/\mathbf{L}_0$ is about 6, and the ratio of neutral hydrogen to total mass H I/$\mathbf{M}$ is 4–5 per cent. The evidence for spiral structure in the Large Cloud is reviewed in Appendix I. A possible interpretation for the discrepancy between radio and optical rotation-velocities is outlined in Appendix II; it appears plausible that the radio estimate of the mass may be too low by a factor $\times 3$ and the optical estimate too high by a factor $\times 2$. *Subject Heading:* **1. Nebulae.**—*Author's abstract.* Ⓢ

4. SOLAR PHYSICS

See also: **Photoelectrons from solar ultraviolet** (Hinteregger et al.), 11.10–43; **Field anomalies due to solar eruptions** (Lauter, Třiska), 11.10–47; **Radio echoes from solar corona** (Burkard), 11.10–97; **Cosmic ray decreases preceding max. solar activity** (Legrand), 11.10–134; **Abnormal foF2 during high solar activity** (Huang), 11.10–152; **Geomag., auroral, ionosph. and cosmic-ray disturbances and solar activity** (Mariani, Molina), 11.10–178; **Solar radio bursts and auroral streams** (Maxwell et al.), 11.10–179; **Geomag. disturbances and sol. radio bursts** (Wood, Warwick), 11.10–198; **Sol. radio emission and geomag. storms** (McLean), 11.10–201; **Auroras, radiation belt and solar wind** (Rees, Reid), 11.10–219.

11.10–68 551.521.1:574.6

Wald, George, **Life and light.** *Scientific American*, N. Y., 201(4):92–108, Oct. **1959.** figs., photos. **DWB, DLC**—A thoroughly readable study in which the author attempts to solve the problem of the interdependence of life and light. He concludes that life depends on a narrow band in the electromagnetic spectrum and life is based on the consequence of the way in which molecules react to radiation. He assumes this as a general rule which must hold true not only on earth but elsewhere in the universe. In the treatment of the subject matter the effects of light, photosynthesis, phototropism, vision and bioluminescence are broadly discussed. At the end of the article, the author points to the fact, that relationship between light and life is reciprocal and evolution on a dark planet cannot arise. *Subject Headings:* **1. Spectral radiation 2. Photobiological effects 3. Light effects.**—*E.K.* Ⓢ

11.10–69 523.75

†Roberts, Walter Orr and Zirin, Harold (*both, Univ. Colorado*), **Recent progress in solar physics.** *Journal of Geophysical Research*, Wash., D. C., 65(6):1645–1659, June **1960.** 4 figs.,

table, 33 refs. **DLC**—A number of significant recent advances in solar physics are reviewed. New kinds of observations made during the present sunspot cycle, which began in 1954, have emphasized still further the apparent complexity of solar phenomena and the need of non-equilibrium theoretical treatments. Among the new developments discussed are solar cosmic rays and high-energy particles, flares and prominences, coronal condensations, solar magnetic fields, and solar radio noise emission. Theoretical analyses of the conditions of the solar atmosphere as a hot plasma, and as a gaseous ensemble exhibiting gross departures from thermodynamic equilibrium, are discussed. New work on atomic collisional parameters is also reviewed. The article concludes with a synopsis of certain major unsolved problems of the solar atmosphere. *Subject Headings:* **1. Solar physics 2. Progress in solar physics.**—*Authors' abstract.* Ⓢ

11.10–70 523.746:778.3

Bray, R. J. and Loughhead, R. E. (*both, Div. Physics, G.S.I.R.O., Univ. Grounds, Chippendale*), **High resolution observations of the granular structure of sunspot umbrae.** *Australian Journal of Physics*, Melbourne, 12(4):320–326, Dec. **1959.** 4 figs., 15 refs. **DLC**—High resolution photographs of sunspot umbrae have confirmed the existence of an umbral granulation, resembling the photospheric granulation but differing in regard to lifetime and cell size. Bright structures in the form of "loops" are also seen. Quite apart from the granulation, the intensity contours of spot umbrae show a detailed and complex structure. *Subject Heading:* **1. Sunspot umbrae.**—*Authors' abstract.* Ⓢ

11.10–71 523.74

Mergentaler, Jan (*Wroclaw Astronomical Inst.*), **Sunspots in the year 1958.** *Acta Geophysica Polonica*, Warsaw, 7(2):192–197, **1959.** fig., 3 tables. Polish summary p. 197. **DWB, DLC**—A paper tabulating and graphically illustrating the sunspot observations both photographically and visually, made in 1958. The numerical values of total and umbra areas of sunspots are tabulated. The Wolf numbers resulting from visual observations made by Wroclaw astronomers, together with the values of k index and the rotational means are also separately tabulated. Five-day means of Wolf Numbers for 1958 are graphically represented. *Subject Heading:* **1. Sunspot data.**—*I.S.* Ⓢ

11.10–72 523.746

Waldmeier, M., **Rote Sonnenflecken.** [Red sunspots.] *Zürich. Eidgenössische Sternwarte, Astronomische Mitteilungen*, No. 224, June **1959.** 14 p. 6 figs., 2 tables, 4 refs. Summary in English. **DLC**—Observations of red regions in the umbra of large sunspots are described. Such regions are most likely to occur at the limb of the umbra, often accompanying or preceding the formation of light-bridges across the umbra. Their brightness is larger than that of the umbra, but less than that of the penumbra. Red regions in sunspots represent infrequent but rather stable phenomena. Very little is known at present of their physical nature. *Subject Headings:* **1. Sunspot umbrae 2. Red sunspots.**—*Author's abstract.* Ⓢ

11.10–73 523.74/5

Waldmeier, M. and Bachmann, H., **Statistik der Sonneneruptionen 1945–1954.** [Statistics on solar eruptions, 1945–1954.] *Zeitschrift für Astrophysik*, Berlin, 47(2):81–93, **1959.** 2 figs., 9 tables, 5 refs. Summary in English p. 81. **DLC.** Reprinted as *Zürich. Eidgenössische Sternwarte, Astronomische Mitteilungen*, No. 220. **DLC**—Supplementing an earlier publication the statistical investigation of solar flares has been continued through cycle no. 18 (1945–1954), using the material published in the "Quarterly Bulletin on Solar Activity." Out of 4828 observed flares 79% are of importance 1, 18% of importance 2 and 3% of importance 3. The frequency of flares was found again to be proportional to the sunspot numbers, but in cycle no. 18 the flare activity has dropped to 72% of that during cycle no. 17 (reduced to the same sunspot number). The average lifetime of a flare is 22 min for importance 1, 45 min for importance 2 and 85 min for importance 3. The distribution of flares in heliographic latitude follows very closely that of the sunspot-groups. There is no systematic displacement between flares and spots larger than 0.2° in heliographic latitude. The frequency of flares decreases with increasing angular θ from the central meridian approximately proportionally

to cos θ. The rate of decrease is only partially explained by foreshortening; chromospheric absorption has also to be taken into account. Flare activity is greater in the eastern than in the western hemisphere and shows a decrease in the interval $\theta = 11°$ to 20°. *Subject Headings:* **1. Solar flare data 2. Sunspot-flare relationships.**—*Authors' abstract.* Ⓢ

11.10–74 551.594.12:523.755:523.746

Licht, A. L. (*Nat. Aeronautics and Space Admin., Wash., D. C.*), **Properties of the solar wind during sunspot minimum.** *Journal of Geophysical Research*, Wash., D. C., 65(5):1397–1400, May 1960. 4 figs., 5 refs., 23 eqs. **DLC**—Parker's model of a spherically expanding corona, the solar wind, is compared with D. E. Blackwell's observations of the 1954 minimum equatorial corona. A significant discrepancy is found between the predicted and the observed electron densities at distance from the sun greater than 20 solar radii. Blackwell's data are found to be consistent with a model in which the corona expands mostly within a thin disk, of thickness less than 25 solar radii, and lying within the sun's equatorial plane. The thickness of the disk as a function of distance from the sun is qualitatively explained in terms of magnetic pressure. *Subject Headings:* **1. Solar wind 2. Sun's corona.**—*Author's abstract.* Ⓢ

11.10–75 523.75:551.510.62:621.396.8

DeMastus, Howard and Wood, Marion (*Nat. Bureau of Stands. Boulder, Colorado*), **Short-wave fadeouts without reported flares.** *Journal of Geophysical Research*, Wash., D. C., 65(2):609–611, Feb. 1960. fig., 2 tables, 2 refs. **DLC**—Short-wave fadeouts were sought which had no associated Hα flare. To carry out this study, Sacramento Peak flare patrol films were re-examined for those days on which short-wave fadeouts (SWF's) had occurred during patrol times without reported flares. Fifteen such fadeouts were reported during the IGY period. Upon re-examination of the films, 12 of the SWF's were found to be in close time association with outstanding Hα events, usually in the nature of pronounced plage brightenings. In 2 other cases, seeing was so poor that no definite statement could be made about possible Hα activity. In only 1 case was there definitely no unusual Hα event in time association with the fadeout. For each of the 15 cases, the flare film for the entire day was re-examined without previous knowledge of the time of the SWF. Any periods of outstanding Hα activity were selected and their times noted; only after their independent selection were their times matched to SWF times. Usually, there was only 1 such outstanding period of optical activity per day. The time association with SWF was, in general, very close. The results indicate that outstanding Hα activity is essential in time relation with SWF occurrence. *Subject Headings:* **1. Solar radio-communication relationships 2. Radio fading.**—*Author's abstract.* Ⓢ

11.10–76 523.75:550.385

Howard, Robert; Cragg, Thomas and Babcock, Horace W. (*all, Mt. Wilson and Palomar Obs., Pasadena, Calif.*), **Magnetic field associated with a great solar flare.** *Nature*, London, 184(4683), Supp. No. 6:351, Aug. 1, 1959. ref. **DWB**—An unusually large double spiral configuration of solar flare, having an intensity of 3+, was observed at Mount Wilson on July 16, 1959. Its active region was approximately 18°N, 29°W. It was visually observed. The observatory obtained 14 fine-scan magnetograms, 6 hydrogen spectroheliograms and 49 spectroheliograms of the flare in 3½ hours. Analysis of the magnetograms shows that there was no change in the magnetic pattern. *Subject Headings:* **1. Solar flares 2. Solar flare effects on geomagnetism.**—*N.N.* Ⓢ

11.10–77 523.75:523.164.82

McNarry, L. R. (*Nat. Res. Council, Ottawa*), **Distribution of flares on the solar disk associated with noise.** *Nature*, London, 184(4689), Supp. No. 11:806, Sept. 12, 1959. fig., 5 refs. **DWB**—The reported examination of the association of solar noise bursts at 48 mc/s and solar flares is based on the data obtained from the auroral radar film records at Resolute (75°N, 95°W). The periods covered are June 20–July 31, 1957, Sept. 1–Oct. 1, 1957, and June 1–July 31, 1958. This period recorded a total of 535 bursts with 12% of the noise-producing flares occurring within ±5° of the central meridian, while for the same periods 8% of all flares occurred in the same interval. The data graphically represented indicate a definite peak in flares associated with noise near the central meridian. The north-south distribution

for the same periods, also graphically represented, show a great preponderance of flares in the northern hemisphere. It is concluded that the present conditions in the solar corona favor the emission of radio noise at very high frequencies from flares occurring in the north-west quadrant of the solar disk. *Subject Headings:* **1. Solar flare emissions 2. Solar radio noise bursts.**—*I.S.* Ⓢ

11.10–78 523.75

Tandberg-Hanssen, E. and Zirin, H. (*both, Univ. Colo.*), **Physical conditions in limb flares and active prominences, Pt. 1, The loop prominences of November 12 and 22, 1956.** *Astrophysical Journal*, Chicago, 129(2):408–413, March **1959.** 6 figs., 4 tables, 3 refs., eq. **DWB, DLC**—Spectra of two bright, flarelike loop prominences have been analyzed; it is found that the emission lines (in particular Hα, Hγ, He I 4713, and He II 4686) have profiles closely fitted by a Gaussian distribution of intensity. The measured line widths, however, show different temperatures for the different atoms. The neutral helium lines are more than half as broad as the hydrogen lines, and the He II line is much broader than the He I lines. It is necessary to conclude that the lines originate in intertwined regions of different temperatures. Relative mass motions of the order of 70 km/sec were measured between different branches of one of the prominences. *Subject Heading:* **1. Solar prominence spectra.**—*Authors' abstract.* Ⓢ

11.10–79 523.75:551.521.67

Ward, W. H. (*Dominion Phys. Lab., Lower Hutt, New Zealand*), **On the origin of terrestrial particles from solar flares.** *Journal of Atmospheric and Terrestrial Physics*, New York, 14(3/4): 296–298, June **1959.** fig., 8 refs. **DWB, DLC**—"A mechanism which might lead to ejection of charged particles from the sun is suggested. It arises from a local cancellation of the magnetic field of a pair of sunspots by a general field." TELLER (1954) dealing with the energies and motions of particles in the corona came to the conclusion that assuming a high velocity and high density of particles in the magnetic field of the sun the motion of the ionized material becomes determined by the magnetic lines of force. Some of the particles of the corona will move along with the magnetic field toward the open space. Some of the particles which are not released will travel in a helix round a magnetic field which links one sunspot with some magnetic discontinuity; possibly the earth, in which case the particles will be directed to it. Findings and hypotheses of KIEPENHAUER, FERMY, ELLISON, DENISSE, WILD and ZIRIN support this theory. *Subject Heading:* **1. Solar flare emissions.**—*O.T.* Ⓢ

11.10–80 523.755:535.33

Waldmeier, M., **Beobachtungen an der Koronalinie 5694 Å.** [Observations on the coronal line 5694 Å.] *Zeitschrift für Astrophysik*, Berlin, 47:94–105, **1959.** 4 figs., 3 tables, 16 refs. Summary in English, p. 94. **DLC.** Reprinted as *Zürich. Eidgenössische Sternwarte, Astronomische Mitteilungen*, No. 220. **DLC**—Between sunspot minimum (1954) and maximum (1957) 118 coronal emission regions of the line 5694 Å have been observed, none in 1954, 3 in 1955, 39 in 1956 and 76 in 1957. During 1957 this line was found on 91% of all days. The distribution of the 5694 emission according to heliographic latitude is very similar to that of the sunspot groups, but is shifted to higher latitudes by about 5°. For individual spot groups the 5694 emission is distributed symmetrically to the center of the group. From these two results one concludes, that spot groups in higher latitudes are more likely to be accompanied by an 5694-emission than spot groups at lower latitude. In 9 regions of high 5694-intensity the line 5445 has also been observed. The intensity ratio of the two lines $I_{5445}:I_{5694}$ seems to increase with the line intensity, reaching maximum values of 1:3 to 1:2. *Subject Heading:* **1. Coronal emission lines.**—*Author's abstract.* Ⓢ

11.10–81 523.755:523.164.42

Newkirk, G. A.; Curtis, G. W.; Watson, D. K. et al., **The inner solar-corona during June 1959.** *Nature*, London, 184(4695) Supp. No. 17:1308–1309, Oct. 24, **1959.** 6 figs., table, 3 refs. **DWB**—The study of the solar occultation of the Taurus A radio source has yielded new information on the structure of solar corona at great distances. But the interpretation of these observations is hampered by the lack of knowledge of electron densities prevailing in corona at the time of occultation. Since the Taurus A source passes to the south of the sun, the south solar region is of particular interest. The electron densities over this

region would be 0.3 times the values for a corona at sunspot maximum. The observations of June 9 and 11 do not show change but by June 17 the dip near the south pole disappeared. The tracings show a ray-like structure in southeast. *Subject Headings:* **1. Sun's corona 2. Electron density in sun's corona 3. Radio star occultations. I. Manning, R. II. Shelby, J.**—*A.H.K.* Ⓢ

11.10–82 523.755:523.852:523.164.42

Slee, O. B. (*Univ. Grounds, Chippendale, N. S. W.*), **Occultations of the Crab nebula by the solar corona in June 1957 and 1958.** *Australian Journal of Physics*, Melbourne, 12(2):134–156, June **1959.** 12 figs., 2 tables, 15 refs. **DLC** A description is given of some observations of the occultations of the Crab nebula by the solar corona in June 1957 and 1958, obtained with pencil-beam, fan-beam, and interferometer-type instruments. It is shown that the distribution of 85.5 Mc/s radiation on days when the angular separation is less than 10 solar radii is not consistent with a symmetrical scattering process. Better agreement is obtained by postulating the existence of scattering and regular refraction of comparable magnitude. Certain unexplained features of the pencil-beam distributions indicate that large-scale electron irregularities may be important in the scattering and refraction process. Additional evidence is presented for very short-term changes in the transmission properties of the corona. *Subject Headings:* **1. Radio star occultations 2. Sun's corona 3. Electron density in sun's corona.**—*Author's abstract.* Ⓢ

11.10–83 523.753

*Godoli, G. and Strocchi, M. P., **Numeri caratteristici dei floculi d'idrogeno e di calcio e dei filamenti d'idrogeno per l'anno 1956.** [The characteristic numbers of hydrogen and calcium flocculi and hydrogen filaments for the year 1956.] *Annali di Geofisica*, Rome, 10(1/2):133–137, **1957.** fig., table, 2 refs. Italian and English summaries, p. 137. **DLC**—The characteristic daily values for Ca and hydrogen flocculi and for Hα filaments for 1956 are presented in extensive tables and discussed. The observations were made at the Arcetri solar tower. Since October 20, 1956, three Hα spectroheliograms are made in succession every day and 3 K_{213} of ionized calcium. Results shown on a graph. *Subject Headings:* **1. Solar flocculi data 2. Solar filaments 3. Arcetri Observatory, Italy.** *M.R. & authors' abstract.*

11.10–84 523.753

Godoli, G., **Sulla consistenza della determinazione dei numeri caratteristici dei flocculi di calcio.** [Consistency in determining the character figures of Ca flocculi.] *Annali di Geofisica*, Rome, 12(4):515–521, Oct./Dec. **1959.** 9 figs., table, 7 refs. Italian and English summaries p. 521. **DLC**—Comparing monthly, half yearly and yearly means of the character figures of Ca flocculi determined at Arcetri, Ikomasan and Tokio, information is deduced on the accuracy of the determinations of the character figures of Ca flocculi. *Subject Heading:* **1. Solar flocculi data.**—*Author's abstract.* Ⓢ

11.10–85 523.753

Mustel', E. R., **Ob osnovnom istochnike solnechnykh korpuskuliarnykh potokov.** [The main source of solar corpuscular streams.] *Akademiia Nauk SSSR, Doklady*, 128(2):265–268, **1959.** 17 refs. **DWB, DLC**—The greatest number of geomagnetic disturbances, the M-disturbances, if the entire cycle of solar activity is considered, are produced by flocculi or more exactly by approximately radial streams of corpuscles issuing from these flocculi. This explains in part the 27-day period of the M-disturbances, the seasonal variations, etc. In the projection on the solar disk the boundaries of the flocculi coincide with the boundaries of the bright coronal region in the 5303 Å line superposed upon the disk and with the boundaries of the bipolar magnetic field. The stream of corpuscles from the active surface is determined by its magnetic field, and the last elements of geomagnetic sequences in the absence of flocculi and a bright corona in λ 5303 Å are produced by unipolar magnetic regions. The streaming of corpuscles may be associated with the magnetism of an ionized gas. The mean velocity $\bar{v}_1$ of the corpuscles depends upon the mean potential of the magnetic field H of the active regions while H itself is associated statistically with the absolute level of solar activity. The range of velocities of corpuscles in the streams does not vary appreciably with the phase of solar activity. The constancy of Δv with time is explained by the fact that the spectrum of velocities is deter-

mined by inhomogeneities in the structure of active regions and these inhomogeneities are similar throughout all phases of solar activity. The mean duration ΔT of a single M-disturbance increases with the phase of the cycle as a consequence of the approximate constancy of Δv and simultaneous decrease of $\bar{v}$ with phase. The radial ejection of the corpuscles from flocculi may be the result of the radial character and the rectilinearity of the coronal forms. The physical state of the condensations constituting the corpuscle streams may be an actually frozen magnetic field. *Subject Headings:* **1. Solar flocculi 2. Corpuscular emissions from sun 3. Solar-geomagnetic relationships.**—*I.L.D.* Ⓢ

11.10–86 523.755

†Jensen, Eberhart, **On the dynamics of prominences and coronal condensations.** *Astrophysica Norvegica*, Oslo, 6(9):93–111, Sept. **1959.** 3 figs., 2 tables, 22 refs., 18 eqs. **DWB**—In the introduction various possibilities for the formation of prominences and coronal condensations are discussed. Sections 2 and 3 contain a brief description of the general physical properties of the corona and coronal formations. The behaviour of a plasma in a magnetic field having a weak inhomogeneity is analyzed in Section 4. It is here shown that when a plasma is not in thermal equilibrium, with $\Delta = E_{\perp} - 2E_{\parallel} \neq 0$, an inhomogeneous magnetic field will have an influence upon the density distribution in the plasma. When $\Delta > 0$ the plasma behaves like a "diamagnetic" medium, being pushed to places where the magnetic field is smallest. When $\Delta < 0$, the plasma behaves like a "paramagnetic" medium moving towards regions of larger field strength. $\Delta \neq 0$ is supposed to be maintained by changes in the magnetic field with time. Depending upon the value of the characteristic scale of the inhomogeneity, the required time-constant for the variations in the field comes out as 30 to 10^4 sec. In the concluding section the consequences for the formation and dynamics of prominences and coronal condensations are briefly discussed. *Subject Headings:* **1. Sun's corona 2. Solar prominences.** —*Author's abstract.* Ⓢ

11.10–87 523.755

Billings, D. E. (*High Alt. Observ. Univ. Colorado*), **Distribution of matter with temperature in the emission corona.** *Astrophysical Journal*, Chicago, 130(3):961–971, Nov. **1959.** 8 figs., table, 16 refs., eq. **DWB, DLC**—Analysis of over one thousand profiles of the coronal emission lines λ 5303 and λ 6374 yields (a) an empirical multiplier for converting S-wave ionization cross-sections for Fe XIV to total cross-sections and (b) the relative amount of coronal matter as a function of temperature in each of the following situations: (1) in sunspot latitudes during the winter of 1956–1957; (2) in specific coronal regions; and (3) in polar regions. All the distributions but one maximized at or near 2.4×10^{6}°K. This distribution, in a region emitting λ 5694 of Ca XV, maximized at a temperature higher than 3,000,000°. *Subject Headings:* **1. Sun's corona 2. Coronal emission lines.**—*Author's abstract.* Ⓢ

11.10–88 523.77

Adel, Arthur, **Grating resolution at 6.3 microns in the solar-telluric spectrum.** Arizona. State College, Flagstaff, Arizona, Contract AF 19(604)-2177, Scientific Report No. HB-7, Aug. 10, **1959.** 19 p. 4 figs., 3 refs. **DWB**—The ephemeral atmospheric window at 6.3 microns has been observed with grating resolution. Twenty-five spectra of the region 6.150 mu–6.350 mu are reproduced. *Subject Headings:* **1. Solar spectroscopy 2. Atmospheric windows.**—*Author's abstract.* Ⓢ

11.10–89 523.77:550.38

Reiffel, L. (*Physics Div., Armour Res. Found., Chicago, Illinois*), **Observations on the general solar plasma instability.** *Physical Review Letters*, N. Y., 4(3):136–138, Feb. **1960.** 12 refs., 6 eqs. **DLC**—To understand the problem of instabilities in the solar plasma streams that exist just beyond the orbit of the earth, it is necessary to use occasional very intense solar streams as probes in order to obtain adequate information on the time-dependence of such emissions. Data on magnetic storms, their intensities and the energy exchange processes at the time of storms are of added advantage towards the solution. The magnetic field within the region is unpredictable, but the instabilities vary between 1.5×10^{13} cm and twice that much. This report presents dimensional information on the efficiency of energy exchange processes. *Subject Heading:* **1. Solar-geomagnetic relationships.**—*N.N.* Ⓢ

11.10–90 523.77:523.877

Schmeidler, F. (*Munich*), **Über das Turbulenzspektrum der thermischen Konvektion in der Sonne.** [Turbulence spectrum of thermal convection in the sun.] *Astronomische Nachrichten*, Berlin, 285(2):65–70, July **1959.** 13 refs., 19 eqs. **DLC, NRL**—A mass of gas which is convective because of thermal instability, has a turbulence spectrum different from that of hydrodynamic turbulence, because it is largely determined by the thermal uplift. It results from the mechanism of convection that a rising hot element will form a larger element by heat transfer to the environment, from this large element a still larger will form in the same way, and so forth. The diameter of the largest elements is approximately equal to the scalar magnitude of the temperature change. The velocity of the elements is proportional to the square of their diameter. For the smallest elements the hydrodynamic spectrum is a limiting case. The energy dissipation can be neglected in considering the total turbulence energy, as long as the largest elements approximate adiabatic behavior. *Subject Headings:* **1. Thermal convection in sun 2. Turbulence spectrum of sun's thermal convection 3. Solar turbulence.** —*Transl. of author's abstract.* Ⓢ

11.10–91 523.774

†Unno, Wasaburo (*Tokyo Univ. and Mich. Observ.*), **Turbulent motion in the solar atmosphere, Pt. 1, Doppler widths of photospheric lines.** *Astrophysical Journal*, Chicago, 129(2): 375–387, March **1959.** 3 figs., 2 tables, 23 refs., 14 eqs. **Pt. 2, Turbulent velocities in the lower chromosphere.** *Ibid.*, 129(2):388–400, March **1959.** 2 figs., 4 tables, 24 refs., 32 eqs. **DLC, DWB** –In Pt. 1 the method proposed by GOLDBERG (1958) is applied to twenty-five pairs of multiplet lines of moderate intensity in order to determine Doppler widths in various optical depths in the solar photosphere at the center of the disk of the sun. The turbulent velocity is found to decrease with height. The derived velocities are 1.55, 1.08, and 0.75 km/sec, corresponding to the optical depths 0.6, 0.4, and 0.2 at λ 5000 A. According to Pt. 2 eight pairs of strong multiplet lines are measured and used for the determination of Doppler widths by means of Goldberg's method (1958). The resultant Doppler widths are corrected for the effect of noncoherent scattering. The turbulent velocity is found to increase with height: it is about 1.9 and 3.5 km/sec at the height of 500 and 1000 km above the base of the chromosphere, respectively; and its variation is found to be approximately inversely proportional to the one-fourth power of the density. From this it is concluded that the chromospheric turbulence is due to the acoustic noise scattered by the inhomogeneous structure of the chromosphere; and the energy transport to the corona by this acoustic noise is found to be just sufficient to balance the total radiation energy emitted from the corona. *Subject Headings:* **1. Solar turbulence 2. Doppler displacement in solar spectrum.**—*Author's abstract.* Ⓢ

11.10–92 523.79

Brekke, Kjell, **A high-speed rotating disk shutter for photographing the solar disk.** *Oslo. Universitet. Instituut for Teoretisk Astrofysikk, Report* No. 5, June **1959.** 26 p. 15 figs., 7 refs., 22 eqs. **DWB**—A high-speed rotating slit-shutter has been built for photographing the solar disk in direct focus of a long-focus instrument at the Solar Observatory, Harestua. The phenomenon of variable vignetting, inherent in rotating shutters, are removed by suitable tilt of the edges of the slit. The theory behind the technical design is presented in Part I. Part II deals with the technical details of the shutter equipment. *Subject Heading:* **1. Solar photography.**—*Author's abstract.* Ⓢ

5. ECLIPSES

See also: **Eclipse effects on ionosphere** (Bowman), 11.10–142; **"Valley effect" in ionospheric eclipse records** (Gledhill, Walker), 11.10–148.

11.10–93 523.78

Stewart, John W. (*Dept. Phys. Univ. Va. Charlottesville*), **The total solar eclipse of Oct. 2, 1959.** *Weatherwise*, Boston, 12(4):151–153, 165–167, Aug. **1959.** 3 figs., table. **DWB** –The chances of seeing the moon's shadow before sunrise are discussed. Details of the path, duration and probable weather conditions during the total eclipse of Oct. 2, 1959 from Nashua, New Hampshire (sunrise) to the Canary Islands, North Africa and the Indian Ocean (sunset), and

hints to observers for making the best of their opportunity, are given and illustrated by detailed charts. The next total eclipses in the U. S. will be 1963, 1970, 1979 and 1984. *Subject Heading:* **1. Solar eclipses.**—*M.R.* Ⓢ

11.10–94 523.78

Rubin, Vera C. (*Georgetown College Obs.*), **Solar limb darkening determined from eclipse observations.** *Astrophysical Journal*, Chicago, 129(3):812–825, May **1959.** 2 figs., 6 tables, 17 refs., 36 eqs. **DWB, DLC**—Photoelectric observations of the crescent sun, obtained during the total eclipse of the sun, February 25, 1952, at three sites in Africa are analyzed to determine the coefficients which characterize the brightness distribution of the extreme limb of the sun, i.e., the outer 1.2 per cent of the solar semidiameter. The brightness distribution is assumed to be of the form $J(p)=c_0+c_1(1-p^2)^{\frac{1}{2}}$. Corrections for the irregular lunar profile are included. It is shown that the value of the ratio c_1/c_0 is extremely sensitive to the choice of the diameter of the moon. When the occultation diameter is adopted, the result is $c_1/c_0=4.4\pm0.9$ (m.e.). From the intensity reading of the full moon and PIERCE's (1954) observations for the inner solar disk, the final adopted expression for the limb darkening is $\tau(p)=0.34\pm1.5(1-p^2)^{\frac{1}{2}}$, $0.988\leq p\leq 0.999$; the intensity at the center of the solar disk is unity. *Subject Headings:* **1. Solar limb darkening 2. Solar eclipse, Feb. 1952 3. Africa.**—*Author's abstract.* Ⓢ

6. MOON

11.10–95 550.380:523.32:523.77

Neugebauer, Marcia (*Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena*), **Question of the existence of a lunar magnetic field.** *Physical Review Letters*, N. Y., 4(1):6–8, Jan. **1960.** 5 eqs., 4 refs. **DLC**—The magnetometer on the vehicle, reportedly did not detect any evidence of a lunar magnetic field following the recent Soviet moon impact. The magnetometer was capable of detecting fields down to 6×10^{-4} gauss. The present note points out that this single piece of data is not sufficient evidence to allow the conclusion that the general lunar magnetic field is weaker than 6×10^{-4} gauss on the surface. A general magnetic field, if existent, would be confined by the solar corpuscular radiation, or solar wind, to a thin layer above the sunlit surface where the Soviet moon impact occurred, but it could extend a considerable distance beyond the surface on the side away from the sun. *Subject Headings:* **1. Lunar magnetic field 2. Magnetometers 3. Corpuscular emissions from sun.** —*I.S.* Ⓢ

11.10–96 523.323.1:581.14

Schindler, Gerhard, **Die Vollmonddaten der letzten 110 Jahre.** [Full moon data for the last 110 years.] *Meteorologische Rundschau*, Berlin, 12(4):132–133, July/Aug. **1959.** table, 3 refs. **DWB, DLC**—The practical, in particular legal, importance of accurate full moon data, the possible relationship between plant growth and moonlight and between moonlight and bird flight etc. are discussed. The synodic month, the rising and setting of the full moon, the time division during the interval 1851–1960 covered by the full moon data presented, and astronomic statistical characteristics of the full moon occurrences are considered. A table giving the full moon data for the period 1851–1960 is presented. *Subject Headings:* **1. Lunar cycles 2. Lunar effects 3. Full moon data.**—*I.L.D.* Ⓢ

11.10–97 523.164.8

Burkard, O. (*Inst. for Met. and Geophysics, Graz Univ.*), **Radio reflexions from the moon and solar corona.** *Nature*, London, 183(4669):1180, April 25, **1959.** 5 refs., 3 eqs. **DWB**—A revised formula for the plane of polarization which is based upon the assumption that there are some hundred electrons per c.c. in the space around the earth is given here. The "old" formula for the rotation of the plane of polarization is also given in this brief discussion. The modification is based on Sputnik I researches. *Subject Headings:* **1. Radio wave reflection from moon 2. Coronal radio wave reflection.**—*W.N.* Ⓢ

11.10–98 523.3

Sharonov, V. V., **Luna i ee priroda.** [The moon and its nature.] *Priroda*, Moscow, No. 1:9–19, Jan. **1960.** 2 figs. **DLC**—In this paper the author reviews and outlines the existing

information about the moon, its topography, the origin of its mountains, the moon's atmosphere, the luminescence of its rocky formations, the coloration of the moon's landscape, the temperature prevailing there at different times and on different parts of the moon's surface, and the structure of the moon's surfaces. All new facts established by science during the last few years are discussed. *Subject Heading:* **1. Moon.**—*A.M.P.* Ⓢ

11.10–99 523.3

Urey, Harold C. (*Univ. of Calif.*), **Criticism of the melted moon theory.** *Journal of Geophysical Research*, Wash., D. C., 65(1):358–359, Jan. **1960.** 7 refs. **DWB, DLC**—The paper deals with the objections raised against KUIPER's melted moon theory (1954). The basic objection concerns the assumption that the compacted solid will be denser than the liquid. If this were the case the configuration would be unstable, and in the event of a disturbance the crust would break up and sink into the liquid. The author mentions three more difficulties in the melted moon hypothesis and concludes that KUIPER's model is inconsistent with very elementary physical and chemical principles and well established observations. *Subject Heading:* **1. Lunar theories.**—*E.K.* Ⓢ

7. PLANETS

See also: **Vaporous matter expanding into vacuum** (Raïzer), 11.10–126; **Planetary influences on atmospheric electricity** (Budai), 11.10–293.

11.10–100 523.12(08)

Safronov, V. S., **Dostizheniia planetnoĭ kosmogonii.** [Achievements in planetary cosmogony.] *Priroda*, Moscow, 7:58–60, July **1959. DLC**—Contains minutes of the 1st International symposium on the origin of the earth and planets held in 1958 in Moscow simultaneously with the 10th International Astronomic Conference. The symposium attended by about 300 delegates showed that the majority of cosmogonists were firmly convinced that the planets were formed not by condensation of gases but by the way of a gradual accumulation of solid particles and bodies of various size. The gas substance has merely joined the large planets at the last stage of their development. *Subject Headings:* **1. Planetary origin symposia 2. Cosmogony.**—*A.M.P.* Ⓢ

11.10–101 523.4:574.6

Gadomski, Jan (*Warsaw Univ. Obs.*), **Fünf Arten von ökosphärischen Planeten.** [Five types of ecospheric planets.] *International Astronautical Congress, 9th, Amsterdam, Aug. 1958, Proceedings*, Vol. 2:785–793, issued **1959.** 3 figs., 4 tables, 2 refs., 13 eqs. English, German and French summaries. **DLC** (TL787.I44)—The surroundings of every star can be divided—after appropriate mathematical considerations—into five different spheres of space where planets of different ecospheric types can exist, namely: 1) the sphere of the "restricted" planets with an "ecospheric belt" upon the "daylight surface" only; 2) the sphere of the "polar" planets with swift rotations which generally are "overheated" by their sun, but can show ecological conditions in their polar regions; 3) The very ecosphere of the fast-rotating animated planets; 4) The sphere of the "equatorial" fast-rotating planets which can have ecological conditions only in their tropical regions; and 5) The sphere of the unanimated planets which do not offer any conditions for organic life because of their low surface temperature. *Subject Headings:* **1. Planetary climates 2. Life on planets 3. Ecosphere.**—*Author's abstract.* Ⓢ

11.10–102 523.4:58

Popov, V. S., **O priznakakh zhizni na planetakh.** [Signs of life on the planets.] *Priroda*, Moscow, No. 11:89–90, Nov. **1959.** fig. **DLC**—Spectrographic studies of Mars both in the visible and infrared regions of the spectrum indicate that there are no green plants identical with those on the earth. G. A. TIKHOV, however, maintains that owing to different environmental conditions on Mars the plant life would be different from that on the surface of the earth. Karatinoid pigments with absorption bands between wave lengths 0.4–0.5μ are observed in the region of maximum energy distribution at the bottom of the Martian atmosphere. Data on the spectral properties of the Martian "seas" indicate strong absorption of long wave

lengths (up to 0.5μ) but the fundamental chlorophyl absorption band has not been found. The differences in spectral reflection between Martian "seas" and terrestrial vegetation can be explained by the characteristics of the Martian climate. The spectrum of Mars shows an absorption band at the wave length of the absorption band of the C-H molecule. From this follows that Mars possesses organic molecules that are not covered by dust and are decomposed by UV radiation of the sun. It is natural to assume that they possess the capacity of reconstitution. *Subject Headings:* **1. Planetary vegetation 2. Martian atmosphere 3. Life on Mars.**—*I.L.D.* Ⓢ

11.10–103 523.43

Kuiper, Gerard P. (*Yerkes Obs., Williams Bay, Wis.*), **The atmosphere and the cloud layer of Venus.** (In: **The threshold of space,** ed. by M. Zelikoff. N. Y., Pergamon Press, **1957.** p. 78–86. 2 figs., 20 refs., 4 eqs.) **DLC**—A review of research results available for the atmospheric conditions on Venus. Contrary to earlier assumptions by Lyot it is now fairly certain that "Venus has no open basins of water and that the atmospheric content of water vapor must be very low." The yellowish color of the cloud layer, observed polarization and similar factors point toward the possibility of C_3O_2 clouds. The radiation temperature of the top of the cloud layer is −36°C, the average surface temperature of Venus probably is around 43°C. The paper discusses the sources of information (spectra, photometry and polarization, radiometric observations and radio data, and gives concise interpretations of the results. *Subject Headings:* **1. Planetary atmospheres 2. Venus.**—*A.A.*

11.10–104 551.521.9:523.42:621.396.8 523.42:535.33

†Sinton, William M. (*Lowell Obs., Flagstaff, Ariz.*) and Strong, John (*Johns Hopkins Univ.*), **Radiometric observations of Venus.** *Astrophysical Journal,* Chicago, 131(2):470–490, March **1960.** 15 figs., 6 tables, 31 refs. **DWB, DLC**—Modern infrared techniques were applied to the measurement of thermal radiation and temperatures of planets. The two nearest planets have the maximum of their thermal emission within the 8–13μ band that is transmitted by our atmosphere with relatively little absorption. The transmission of the atmosphere was determined by extrapolation of observed planetary emission to outside the atmosphere, using the square-root law. Calibration of the equipment was made with black bodies. The method of determining atmospheric transmission was tested in the laboratory with an ammonia cell, to simulate a planetary atmosphere, and a rock, to simulate a planet. Radiation temperatures for the rock within a few degrees of the thermometer temperature were obtained in these tests. Extensive measurements were made of Venus with the 200-inch telescope in 1953, and further measurements were made in 1954. The temperature at the center of the disk was found to be −39°C. Scans near dichotomy show that the dark side of the disk is nearly as hot as the bright side. There is also substantial limb darkening. A cold region found at the north cusp in 1953 appears to be related to a bright cloud found in ultraviolet photographs taken on the same date. Spectra of Venus between 8 and 13μ were obtained with prism and grating spectrometers. A diffuse band at 11.2μ was found in the spectrum of Venus in addition to a carbon dioxide band at 10.4μ. The 10.4μ band was found much weaker than expected. *Subject Headings:* **1. Radiometry 2. Venus 3. Planetary temperatures.**—*Author's abstract.* Ⓢ

8. METEORS

See also: **Cosmic-ray-produced helium in meteorites** (Hoffman, Nier), 11.10–133.

11.10–105 551.510.5:523.5

Verniani, F., **Deceleration of meteors during their passage through the earth's atmosphere.** Florence. Univ., Contract AF 61(052)227, Technical Note, No. 2, June **1959.** 6 p. Unchecked.—The theory of the deceleration of meteors is computed as a function of the characteristic quantities of evaporation, in particular, of velocity. Results show that for over ¾ of all meteors, the deceleration increases until the end of evaporation. At the point of maximum rate of evaporation, the deceleration, as a first approximation, may be assumed the same for all meteors. *Subject Heading:* **1. Meteor deceleration.**—*Author's abstract.* Ⓢ

11.10–106 523.51

Verniani, F., **On the velocity of meteors during their evaporation.** Florence. University, Contract AF 61(052)227, Technical Note, No. 1, June **1959.** 8 p. incl. tables. Unchecked.—Herlofson's equations for meteoric evaporation indicate that part of the meteors cannot evaporate completely because of their excessive loss of speed. Results show that the flight of all meteors is considerably retarded during the entire process of evaporation. *Subject Heading:* **1. Meteor deceleration.**—*Author's abstract.* Ⓢ

11.10–107 523.57:535.243

†Millman, Peter M. and Cook, Allan F., **Photometric analysis of a spectrogram of a very slow meter.** *Astrophysical Journal*, Chicago, 130(2):648–662, Sept. **1959.** 9 figs., 9 tables, 30 refs., 8 eqs. **DWB, DLC**—The spectrum of a very slow meteor photographed from the Meanook Meteor Observatory on October 20, 1952, has been measured photometrically. Comparison is made, for line identifications only, with a spectrogram obtained by the Harvard Meteor Expedition at Soledad Canyon on July 6, 1953. A direct photograph of the 1952 meteor was secured at the Newbrook Meteor Observatory, whence a complete triangulation and reduction for height, velocity, and deceleration was made by L. G. Jacchia at Harvard College Observatory. The light-curve of the meteor has been determined, and its observed physical parameters are discussed. The principal results of the photometric analysis are a profile of the continuum in absolute units at wave lengths longer than 4800 A, believed due to the first positive group of nitrogen bands, and a continuous increase in brightness of these bands relative to the brightness of the meteor along the trail. *Subject Headings:* **1. Meteor spectra 2. Spectrophotometric meteor studies.**—*Authors' abstract.* Ⓢ

11.10–108 551.551.5:523.5

†Hines, C. O. (*Radio Physics Lab., Defence Res. Board, Ottawa, Canada*), **Turbulence at meteor heights.** *Journal of Geophysical Research*, Wash., D. C., 64(8):939–940, Aug. **1959.** 6 refs. **DLC** -A preliminary outline of a new approach to the study of motions at meteor heights is given, the fundamental assumption being that these motions are perturbation velocities associated with propagating atmospheric waves. Several observed features of the large-scale motions are thereby explained, and a basis is laid for the study of associated smaller-scale "turbulent" motions. It is found that smaller-scale motions having appreciable amplitude need not be anticipated a priori, contrary to an earlier conclusion derived from conventional turbulence theory. *Subject Headings:* **1. Upper air turbulence 2. Meteors.**—*Author's abstract.* Ⓢ

11.10–109 551.557:523.5:551.594.12:621.396.9

Manning, L. A. (*Radio Propagation Lab., Stanford Univ.*), **Air motions at meteoric heights.** *Journal of Atmospheric and Terrestrial Physics*, London, 15(1/2):137 140, Sept. **1959.** 10 refs. **DLC**—The results of a method of analyzing the detailed wind structure at meteoric heights based on the fading, diversity and aspect properties of meteor echoes is presented. The method is based on the assumption that a meteor entering the 80–110 km height region produces an initially straight column of ionization of about 25 km height which is acted on by horizontal winds varying in direction and magnitude by height. A consistent picture of the wind structure obtained is described. *Subject Headings:* **1. Ionospheric winds 2. Meteor echo measurement techniques.**—*O.T.* Ⓢ

11.10–110 016:551.501.89:551.590.25:523.5

†Vincent, W. R. and Smith, Frances H., **Summary of literature pertaining to radio studies of meteors and meteor trails.** Stanford Research Institute, Menlo Park, Calif., Contract AF 19(604)-1517, Jan. **1960.** 387 p.—Stanford University has carried out studies on the basic physics of meteors and meteor trails for 15 years, resulting in the compilation of this comprehensive work from all available articles, papers, reports, books and other pertinent literature in English. Abstracts and discussions are included. Soviet and Eastern European papers are listed separately without abstracts. Information acquired from these studies has been applied in the Stanford-Bozeman meteor-burst communication system. *Subject Headings:* **1. Radio meteor trail observation techniques 2. Bibliography on radio observation of meteors.** —*N.N.* Ⓢ

11.10–111 621.396.8:523.51

Bain, W. C. (*D. S. I. R. Radio Res. Sta., Slough*), **The azimuth distribution of oblique reflections from meteor trails and its relation to meteor radiant distributions.** *Journal of Atmospheric and Terrestrial Physics*, N. Y., 17(3):188–204, Feb. **1960.** 10 figs., 5 tables, 14 refs., 7 eqs. **DLC**—Azimuth distributions of the meteor reflections to be expected at various times of day on a 1740 km north-south transmission path at v.h.f. are calculated from three initial radiant distributions of sporadic meteors. These distributions were: (1) a distribution of meteors, magnitude about 7, obtained by workers at Jodrell Bank; (2) a uniform heliocentric distribution in the plane of the ecliptic; (3) a heliocentric distribution uniform over the celestial sphere. It was found that the third of these gave the best fit to the azimuth results obtained by MEADOWS (1958) on such a path at a frequency of 37 Mc/s; the meteors observed extended downwards in intensity to magnitude 10. Calculations on the forward-scattering of radio waves by meteors should therefore be based on this distribution. Observational results are also presented for a very similar path with a frequency of about 70 Mc/s; they resemble those obtained at 37 Mc/s, although not identical to them. The cause of the differences is unknown, but they may be due to the transmitter polar diagram not being identical at the two frequencies. *Subject Headings:* **1. Meteor radiant distribution 2. Radio wave reflection by meteor trails.** —*Author's abstract.* Ⓢ

11.10–112 551.551.5:551.510.535 523.164.85

Manning, L. A. and Eshleman, V. R. (*both, Radio Propagation Lab., Stanford Univ., Calif.*), **Concerning Booker's theory of meteoric reflections.** *Journal of Geophysical Research*, Wash., D. C., 63(4, Pt. 1):737–739, Dec. **1958.** 6 refs. **DWB, DLC**—The authors in a previous paper (*see* 9.11–217, Nov. 1958, *Met. Abstr.*) discussed the theory of BOOKER on the spectrum of turbulence of meteoric echoes and concluded that the small scale (down to 1.3 m with a velocity of 3 m/s) theory does not agree with evidence. In this note they give arguments against the small scale theory: it does not explain aspect sensitivity by under-dense or over-dense trails, the angular spectrum, or the echo decay curves. In the ionosphere many factors tend to make theoretical predictions doubtful: lack of isotropicity, lapse in temperature and density, sporadic ionization layers, localization of turbulence areas, magnetic fields and field aligned reflecting surfaces. *Subject Headings:* **1. Turbulence in ionosphere 2. Booker's theory of meteoric reflection 3. Meteor echo soundings.**—*M.R.*

11.10–113 551.501.81:523.51 523.164.85

Hagfors, T. and Landmark, B. (*Norwegian Defence Res. Estab., Kjeller, Norway*), **Observations of Direction of arrival of long-duration meteor echoes in forward scatter propagation.** *Journal of Geophysical Research*, Wash., D. C., 64(1):19–22, Jan. **1959.** 4 figs., 6 refs. **DLC** — The angular distribution of enduring meteor bursts in forward scattering is studied and compared with the angular distributions observed for the short duration meteor bursts and the turbulent background component. It is concluded that the enduring, fading bursts are due to meteor trails which reflect in a specular manner throughout the time during which they can be observed. *Subject Headings:* **1. Meteor echo duration 2. Radio wave scattering by meteor trails 3. Meteor burst communication.**—*Author's abstract.* Ⓢ

11.10–114 551.501.8:523.5

Weiss, A. A. (*Dept. of Radio Physics, Univ. Adelaide*), **Radio echo observations of the Geminid meteor stream.** *Australian Journal of Physics*, Melbourne, 12(4):315–319, Dec. **1959.** 3 figs., 2 tables, 8 refs. **DLC**—Measurements of radiant coordinates and echo rates from 1952 to 1957 are summarized. A mean radiant of $\alpha = 113.4°$, $\delta = 31.4°$ at solar longitude $\odot = 260.2°$, a small radiant area, and a markedly asymmetrical distribution of meteors across the stream, with a maximum echo rate at $\odot = 260.8°$, all agree with northern hemisphere radio echo observations made between 1949 and 1954. *Subject Headings:* **1. Meteor echoes 2. Radio echoes from meteors.**—*Author's abstract.* Ⓢ

11.10–115 551.501.8:523.53

Weiss, A. A. (*Univ. of Adelaide, Australia*), **The limitations of narrow-beam radio equipments in the detection of weak meteor showers.** *Journal of Atmospheric and Terrestrial Physics*, London, 14(1/2):19–30, April **1959.** 6 figs., 2 tables, 11 refs., 2 eqs. **DLC**—At the

echo rates practicable for a routine survey of meteor activity using a narrow-beam radio equipment, it is shown that the chief limitation to the recognition of weak shower activity is the fluctuations in the rate of detection of background (sporadic) meteors. Examination of echo rates obtained with the Adelaide 67 Mc/s equipment for December 1956 and January 1957 confirms that over short intervals of time the background fluctuations are random. A significance test, intended for use as a search method for weak shower activity and non-random fluctuations in the background activity, is then developed. This test, based on echo rates, is applied to the data for December 1956 and January 1957. *Subject Headings:* **1. Radio echoes from weak meteor showers 2. Adelaide, Australia.**—*Author's abstract.* Ⓢ

11.10–116 551.590.25:551.501.81 551.510.535:551.594.12

Weiss, A. A. (*Dept. Physics, Univ. of Adelaide*), **Elevation, height and electron density of echoing points of meteor trails.** *Australian Journal of Physics*, Melbourne, 12(1):65–76, March **1959.** 7 figs., table, 9 refs., 6 eqs. **DLC**—Continuous and systematic operation of a C. W. equipment which measures simultaneously several characteristics of meteor echoes, including the location in space of the reflection point, provides the basic material for an examination of the geometry of detection of meteor trails by radio equipments and of the processes underlying selection of echoes for measurements of different kinds. At least 60 per cent of all echoes are distorted in some degree, presumably by atmospheric turbulence or by non-specular reflection. This and selection in height due to diffusion of the trail are the two most important selection processes. The distribution of the echoing points of sporadic meteors, in zenith angle and in height, is compared with theoretical expectation. Height distributions found for Arietid and ζ-Perseid meteors agree with other measurements. The height distribution for the Geminid shower is unexpectedly narrow, a fact for which no satisfactory explanation can be advanced. Distributions of electron line densities at reflection points agree qualitatively with known mass distributions and trail shapes. *Subject Headings:* **1. Radio echoes from meteor trails 2. Ionospheric electron density.**—*Author's abstract.* Ⓢ

11.10–117 531.66:533.6.015:523.5

Lavrent'ev, M. A., **Problema probivaniia pri kosmicheskikh skorostiiakh.** [The problem of piercing at cosmic velocities.] *Iskusstvennye Sputniki Zemli*, Moscow, No. 3:61–65, **1959.** 2 figs., 4 eqs. **DLC, DWB.** Summary in *U. S. National Aeronautics and Space Administration, Technical Translation*, F-8, April 1960, p. 5–6. Complete transl. to be issued in the *Technical Translation* series.—The problem of the puncture of a metallic plate at velocities of 50 to 100 kilometers per second is studied. A model of an incompressible medium is proposed for which it is possible to conduct calculations up to the desired limit. A one-dimensional case is considered. The problem of the impact of a plate of a thickness flying at a speed of v_0 on the end of a cylinder with a length of l is studied. The thickness a is considered small in comparison to l. The problem consists in determining the impulse which the rod acquires as a result of the impact. The plate-block is considered as incompressible and absolutely solid. The shaft is considered as a limited case of a collection of absolutely solid infinitely thin plates located infinitely close to one another. Under an inelastic impact, the block of the first plate retains a quantity of motion, and as a result of the increase of mass, a loss of kinetic energy occurs. This will occur with the involvement in motion of each succeeding plate. Calculations are conducted in the limited case of the distribution along the rod of the loss of kinetic energy of the system. The three-dimensional case involves the impact of a pellet against a plate-hemisphere of given radius. As a result of the impact the mass of the pellet (hammer) will increase in accordance with the concept of inelastic collisions; with the increase of mass, the amount of motion will be preserved, but the kinetic energy of the system will be converted into heat. *Subject Heading:* **1. Astroballistic erosion.**—*Author's abstract.* Ⓢ

11.10–118 523.51:551.507.362.1:551.506.22

Lovering, J. F. (*Dept. of Geophysics, Australian National Univ., Canberra*), **Micrometeorite impacts to an altitude of 135 km.** *Planetary and Space Science*, N. Y., 2(1):75–77, Oct. **1959.** table, 4 refs., eq. **DWB**—In view of the discrepancy between the rate of impact reported by satellites and that reported by BERG and MEREDITH detector, it was decided to repeat the latter experiment, using a Longton two-stage rocket. The rocket was fired from the Woomera

Rocket Range, Australia, as part of the IGY Upper Atmosphere Research Program. The present note gives the details of the experiment and discusses the results. The round was fired at night and reached an altitude of 135 km. During the entire duration no impacts were recorded although according to BERG and MEREDITH 276 impacts should have been recorded. An upper limit to the influx rate, consistent with the satellite rates is given. *Subject Headings:* **1. Micrometeorites 2. Rocket meteorite observations 3. IGY rocket program.** —*I.S.* Ⓢ

11.10–119 523.51

†Williams, David T. (*Univ. Florida, Gainesville, Fla.*), **A fluid-dynamic mechanism of meteorite pitting.** *Smithsonian Contributions to Astrophysics*, Wash., D. C., 3(6):47–67, **1959.** 41 figs. (incl. photos), 31 refs., 12 eqs. **DWB**—Flow lines on meteorites were photographed to determine the nature of airflow inside the "thumb pits" in the surface. The flow is shown to be consistent with that occurring if a hairpin-shaped vortex were lying with bent portion in the pits, with vortex legs trailing off to infinity downstream. Since such a flow is not unique to supersonic fluid speeds, the prediction is made that pits similar to those on meteorites would be observed on salt cakes pushed through a lake. Experiments demonstrated that salt cake erosion may indeed be accompanied by pit formation due to vortices precisely like those detected in meteorite pits. The evidence, supplied by photographs, leads to the conclusion that pitting is a general phenomenon in eroding fluid flow, and that tests at low speeds may provide valuable information regarding certain problems in astroballistic ablation. *Subject Headings:* **1. Meteorite pitting 2. Astroballistic erosion.**—*Author's abstract.* Ⓢ

11.10–120 523.51:551.510.42:546.72

Kreiken, E. A. (*Ankara Univ. Astronomical Inst., Ankara, Turkey*), **The fall-out of meteoric iron particles.** *Planetary and Space Science*, N. Y., 2(1):39–48, Oct. **1959.** 2 figs., 7 refs., eqs. **DWB**—The present paper is a survey of the attempts, which during recent years have been made at the Astronomical Institute of Ankara University: (1) to determine the daily amounts of the fall-out of iron particles of meteoric origin; (2) to study the seasonal variations of the fall-out; and (3) to compare the curve representing these seasonal variations of the fall-out with the one representing the seasonal variations in meteoric activity. The results obtained up till now are critically discussed and possibilities for improving the methods of observation are indicated. *Subject Headings:* **1. Meteoric dust falls 2. Atmospheric pollution 3. Iron.**—*Author's abstract.* Ⓢ

11.10–121 523.51

O Tungusskom meteorite. [The Tungus meteorite.] *Priroda*, Moscow, No. 11:84–85, Nov. **1959. DLC**—A summary of a discussion of the Tungus meteor held at the Institute of Physical Problems of the Academy of Sciences of the USSR. If the meteorite had struck the earth with the computed energy equal to one million tons, a crater of 200 m in diameter would have been formed. In the absence of such a crater the meteorite must have exploded at some height. The axial symmetry is most likely the result of ballistic waves. On the assumption that the meteorite approached the earth at an angle of 8–18° and combustion occurred in the atmosphere it would have produced a wave with an axis of symmetry in the direction of motion so that the fragments would have fallen in front of the zone of destruction. An experiment testing the hypothesis is described. On the basis of formulas obtained from the experiment it was possible to calculate the following: angle of trajectory = 8–18°; speed of the meteorite = 10–50 km/sec; height of explosions above surface of the earth = 100–500 m; radius of meteorite = 15–50 m; energy produced = 4×10^{23} erg; density $p \geqslant 0.5$ g/cm^3. These data were disputed. It is known that the meteorite moved in the direction southeast to northwest and that the trajectory had an angle of inclination of 7–8°. The meteorite could have been constituted of rock so that fragments would be difficult to find; or it may have been constituted of ice. After the fall of the meteorite anomalous twilights were reported, so that it is possible that the meteorite may have disintegrated in the upper atmosphere. An opinion expressed by a journalist attributed the destruction produced by the Tungus meteorite to hydrogen band explosion brought on from outer space. *Subject Heading:* **1. Tungus meteor.**—*I.L.D.* Ⓢ

11.10–122 523.51

Pokrzywnicki, Jerzy (*Zakład Nauk Geolog. PAN*), **O meteorycie Zaborzyca.** [The meteorite of Zaborzyca.] *Acta Geophysica Polonica*, Warsaw, 7(2):182–188, **1959.** 14 refs. French summary, p. 188. **DWB, DLC**—A paper examining and correcting the data given in world meteoritic literature concerning this meteor. The year 1818 as the date of its fall, and the estimated weight of the fallen mass by WULFING and by the British Museum catalogue are held erroneous. This paper gives the exact date of fall as 6 p.m., April 11, 1819, and the weight as approximately 19.75 kg. The chemical analysis of the meteorite and the distribution of its mass among the world collections are also reported. *Subject Heading:* **1. Meteorites.** —*I.S.* Ⓢ

11.10–123 523.51

Pettersson, Hans (*Oceanog. Inst. Gothenburg*), **Frequency of meteorite falls throughout the ages.** *Nature*, London, 183(4668):1114, April 18, **1959.** 6 refs. **DWB**—Swedish studies of cosmic spherules present in sediments from great oceanic depths contradict PANETH's statement that "iron and stone meteorites did not fall before the late Quaternary." If and when the plan to drill through the ocean's bottom to the underlying bedrock will be realized it will present an excellent chance to check the variations in meteor frequency since oceans became existent. The plan will cost only a fraction of manned moon communication. *Subject Heading:* **1. Meteorite frequencies.**—*W.N.* Ⓢ

11.10–124 523.51:546.291

†Schaeffer, Oliver A. (*Brookhaven Nat'l. Lab.*), **Cosmogenic rare gas contents of iron meteorites.** *Physics Today*, N. Y., 13(2):18–22, Feb. **1960.** 6 figs., 2 tables, 17 refs. **DWB, DLC**—It is estimated that each day one thousand tons of meteoric material are swept up by earth's gravitational pull. A study of the age of iron meteorites should be helpful to understand the solar system. Cosmic ray reactions produce helium in a meteorite and the amount of helium can help determine the age of a meteor. *Subject Headings:* **1. Meteoritic helium 2. Cosmic ray effects on meteorites.**—*A.H.K.* Ⓢ

11.10–125 523.51:546.291:551.521.64

†Eberhardt, Peter (*Inst. of Tech. & Eng., Univ. Calif.*) and Hess, David C. (*Argonne Nat. Lab., Lemont, Ill.*), **Helium in stone meteorites.** *Astrophysical Journal*, Chicago, 131(1):38–46, Jan. **1960.** 3 figs., 4 tables, 29 refs. **DWB, DLC**—The helium in thirteen stone meteorites was measured by isotopic dilution. The He^4 ages for seven chondrites range from 1.0 to 4.4 billion years. "Cosmic-ray ages," deduced from the He^3 content are lower by several orders of magnitude. *Subject Headings:* **1. Meteoritic helium 2. Cosmic ray effects on meteorites.** —*Authors' abstract.* Ⓢ

11.10–126 523.16:523.51

Raĭzer, Iu. P., **O kondensatsii v oblake isparennogo veshchestva, rasshiriaiushchegosia v pustotu.** [Condensation of a cloud of vaporous matter expanding into vacuum.] *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, Moscow, 37(6):1741–1750, **1959.** fig., table, 9 refs., 26 eqs. English summary, p. 1750. **DWB.** For transl. into English, see the corresponding issue of *Soviet Physics, JETP*, N. Y. **DLC**—The kinetics of condensation of a cloud of vaporous matter expanding into vacuum is considered. It is shown that for a large variety of initial conditions, at infinity the matter expands partly as a gas and partly in the form of very small particles of the condensate, the number and size of these particles being dependent on the evaporated mass and on its initial temperature. It is suggested that when large meteorites strike the surface of planets without atmosphere the ground of the latter and body of the meteorite may evaporate and subsequently condense and that this process may be one of the sources of cosmic dust. The possibilities of laboratory investigation of condensation of metallic vapors and of the properties of the small particles involved are discussed. *Subject Headings:* **1. Meteorites 2. Cosmic dust origin.**—*Author's abstract.* Ⓢ

9. RADIOASTRONOMY

See: **Natural electromagnetic phenomena for space navigation** (Franklin, Birx), 11.10–31; **Extraterrestrial noise in space communication** (Smith), 11.10–50; **Large magellanic cloud** (de Vaucouleurs), 11.10–67; **Distribution of flares with noise** (McNarry), 11.10–77; **Solar occultation of Taurus A radio source** (Newkirk et al.), 11.10–81; **Occultations of Crab nebula by solar corona** (Slee), 11.10–82; **Echoes from moon and solar corona** (Burkard), 11.10–97; **Ionospheric absorption of cosmic noise** (Fredriksen, Dyce), 11.10–147; **Radio noise from auroras** (Dowden), 11.10–167; **Sub-visual auroras and radio noise bursts** (Duncan, Ellis), 11.10–168; **Solar radio bursts and auroral streams** (Maxwell et al.), 11.10 179; **Geomagnetic disturbance and solar radio bursts** (Wood, Warwick), 11.10–198; **Solar radio emission and geomagnetic storms** (McLean), 11.10–201.

D. OUTER ATMOSPHERE

1. COSMIC RADIATION

See also: **Cosmogenic rare gas contents of iron meteorites** (Schaeffer), 11.10–124; **Helium in stone meteorites** (Eberhardt), 11.10–125; **Geomag., auroral, ionosph. and c.-r. disturbances and solar activity** (Mariani, Molina), 11.10–178.

11.10–127 551.521.64:551.577.37:551.515.2

Arakawa, H. (*Meteor. Res. Inst., Tokyo*), **Tremendous rainfall observed at Mount Fuji weather station and liquid water content in the atmosphere.** *Technical Conference on Hurricanes, Miami Beach, Fla., Nov. 19–22, 1958, Proceedings*, issued **1958**(?). Section H6 (4 p.) table, 3 refs. **DWB** (M15.2 A512pr)—Cosmic ray intensities may be influenced by the liquid water content in the typhoon area. Conversely, this knowledge can be utilized in cosmic ray research. *Subject Headings:* **1. Cosmic ray intensities 2. Typhoon rainfall.**—*W.N.*

11.10–128 551.506.22:551.521.64

Chakrabarty, S. K. (*Bengal Engineering College, Howrah*), **Cosmic ray work at the Bengal Engineering College, Howrah.** *Journal of Scientific and Industrial Research*, New Delhi, Sec. A, 17(12), Special Supplement, Dec. **1958.** p. 81–82. 2 figs., 2 refs. **DWB, DLC**—Brief note on the contribution of the Geophysical Laboratory of the Bengal Engineering College, Howrah, to the IGY data collection centre. This comprised continuous recording of the total cosmic ray intensity as observed under 5 cm lead and 1 cm steel, using a spherical ionization chamber. *Subject Headings:* **1. IGY cosmic radiation program 2. Cosmic ray intensities.** —*W.N.*

11.10–129 551.506.22:551.521.64

Chasson, Robert L., **Significance of cosmic-ray monitor observations.** *American Geophysical Union, Geophysical Monographs*, No. 2:71–80, **1958.** 7 figs., 21 refs. **DLC**—Some details of experiments devised to study the solar component and the results obtained and selected experiments designed to observe possible sidereal effects and general properties of the cosmic-ray flux as it is associated with other solar-geophysical phenomena are discussed. The static and dynamic classes of monitor experiments, the instrumentation (counter telescopes for detecting charged particles, ionization chambers, etc.), the determination of meteorological effects upon the intensity of cosmic radiation (barometric pressure fluctuation, atmospheric temperature, mass distribution, etc.) and the results of application of various statistical systems of meteorological corrections to 79 cosmic-ray datum periods selected from geomagnetically quiet times are summarized. The results of studies of important time and spatial variations of cosmic-ray intensity are reviewed; these are (1) nonperiodic variations comprising geomagnetic storms (Forbush decreases, meteorological effects and solar flare increases; (2) periodic time variations which include 27-day recurrence tendency, solar diurnal effects, semi-diurnal effects, seasonal effects and (3) special variations which include latitude and longitude effects, zenith angle effect, altitude dependence, and east and west asymmetry. The IGY program of cosmic-ray monitor studies is outlined and the standard equipment used

is described. *Subject Headings:* **1. Cosmic ray variations 2. IGY cosmic radiation program.** —*I.L.D.*

11.10–130 551.521.64

Ehmert, A. (*Max-Planck-Inst. for Aeronomy, Lindau, Germany*), **Indications for the increased cosmic radiation in the interplanetary space.** *International Astronautical Congress, Amsterdam, Aug. 1958, Proceedings of the 9th Congress*, Vol. 2:639–643, issued **1959.** 2 figs., 7 refs. English, German and French summaries. **DLC** (TL787.I44)—A simple connection was experimentally found between the amplitudes of world-wide variations of cosmic ray intensity and the dependence of this intensity on geomagnetic latitude. It turns out that these variations can be interpreted as changes of an electric potential of the Earth against the deep space. The sun's activity seems to govern this potential. An independent indication for this arises from the difference in the energy spectra of primary protons and α-particles, but these regions may be at the boundaries of the planetary system. Attention is called to the high intensities that occur after the rare outbursts of solar cosmic rays and to particles trapped in the earth's magnetic field. *Subject Headings:* **1. Cosmic ray intensities 2. Geomagnetic effects on cosmic rays.**—*Author's abstract.* Ⓢ

11.10–131 551.521.64:061.6

Forbush, Scott E. (*Dept. of Terrestrial Magnetism, Carnegie Institution of Washington*), **Cosmic ray program: first twelve months.** *American Geophysical Union, Transactions*, 39(5):1004–1010, Oct. **1958.** 4 figs. **DWB, DLC**—A summary report on the cosmic ray program during the first twelve months of operational research is given. Discussions on the variations of cosmic rays with the solar cycle, the rapid decreases during the magnetic storms, the flux of alpha particles and heavy particles, the X-rays, gamma-rays and the small solar flare effects as well as the cosmic ray equator are described as to their characteristics during the period. *Subject Heading:* **1. Cosmic ray research.**—*N.N.*

11.10–132 551.521.64:681.14:621.38

Ford, P. W. (*Physics Dept., Univ. of Tasmania, Australia*), **Printing register.** *Review of Scientific Instruments*, N. Y., 29(8):728–729, Aug. **1958.** 2 figs. **DWB, DLC**—The printing register described and illustrated was developed and used a year at the Physics Dept., Univ. of Tasmania, Australia to record and print data from cosmic ray equipment in the decimal number system. Groups of numbers up to 16 digits can be handled. The maximum count rate is 250 pulses per minute. The register's life expectancy of 10^7 was exceeded without any wear impairing the operation, running cost of which is negligible. *Subject Heading:* **1. Cosmic ray instruments.**—*W.N.*

11.10–133 523.51:551.521.64:546.291

Hoffman, J. H. and Nier, A. O., **Cosmic-ray-produced helium in the Keen Mountain and Casas Grandes meteorites.** *Journal of Geophysical Research*, Wash., D. C., 65(3):1063–1068, March **1960.** 5 figs., 3 tables, 10 refs., eq. **DLC**—The He^3 and He^4 distributions have been measured in the iron meteorites Keen Mountain and Casas Grandes. In the former, a small meteorite (6.75 kg), the He^3 and He^4 concentrations did not depend upon position. In the latter, a large meteorite (1550 kg), a "depth effect" was observed, and contours of constant He^3 and He^4 content could be drawn. An attempt is made to explain the results in terms of the model earlier presented in connection with similar work on the Grant meteorite. *Subject Headings:* **1. Cosmic ray effects on meteorites 2. Meteoritic helium.**—*Authors' abstract.* Ⓢ

11.10–134 551.521.64:523.746:550.386.6

Legrand, J. P., **Les prébaisses de rayons cosmiques en périodes de maximum de l'activité solaire (avril 1957–décembre 1958).** [The cosmic radiation decreases preceding periods of maximum solar activity (April 1957–December 1958.)] *Annales de Géophysique*, Paris, 16(1):140–142, Jan./March **1960.** 8 figs., 7 refs. **DLC**—Records of cosmic ray intensity made during the International Geophysical Year reveal several important cosmic storms. These are usually preceded (by 3 to 8 days) by a cosmic intensity level decrease from 1 to 3% compared with the normal level. The author gives a description of this phenomenon. These

decreases generally coincide with the appearance of strong solar radioelectric activity and sometimes with an increase of magnetic disturbances. The author classifies these decreases in four categories and investigates the various correlations existing between them and solar and geomagnetic phenomena. The onset of decrease may occur in two distinct manners: 1) At the same time as the appearance of a center or of a group of very active centers at the eastern rim of the sun; 2) 20 to 60 hours after a chromospheric eruption accompanied by radioelectric phenomena. In this case, one also observes an increase of the magnetic disturbance or a magnetic storm. This cosmic ray decrease phenomenon may be useful in geophysical forecasting as it helps detect very active centers appearing on the eastern rim of the sun and provides information on the evolution of solar activity. *Subject Headings:* **1. Cosmic ray decreases 3. Geomagnetic effects on cosmic rays 4. International Geophysical Year.**—*A. V.* Ⓢ

11.10–135 537.59:523.16

Perl, Martin L. and Jones, Lawrence W. (*both, Michigan Univ., Ann Arbor*), **Photography of cosmic rays in a luminescent chamber.** *Physical Review Letters*, N. Y., 2(3):116–117, Feb. 1, **1959.** 2 figs., 5 refs. **DWB, DLC**—The counter-controlled high time resolution device described here has been successfully applied to obtain consistently photographs of minimum ionizing cosmic rays in a sodium iodide crystal using available electronic and optical components. Modifications will permit this device to become useful for high-energy particle experiments. This is claimed to be the first time either cosmic rays or minimum-ionizing tracks have been recorded in a luminescent chamber. *Subject Heading:* **1. Cosmic ray photographs.**—*W.N.* Ⓢ

11.10–136 551.521.64

Sekido, Y.; Yoshida, S. and Kamiya, Y. (*all, Phys. Inst. Univ. Nagoya, Japan*), **Further observations of the point source of cosmic rays.** (In: Lehnert, Bo Peter, (ed.), **Electromagnetic phenomena in cosmical physics.** Cambridge Univ. Press, **1958.** p. 441–445. 4 figs., 2 refs., 4 eqs.) **DLC** (QB461.143)—A point source of cosmic rays at $\delta = 0°$, $\alpha = 5^h\ 30^m$, was reported at the Mexico Meeting of IUPAP in September 1955 (*Nature*, Lond., 177:35, **1956**). The existence of the point source was verified by further observation. This phenomenon suggests the possibility of a direct method of exploring interplanetary space. *Subject Heading:* **1. Cosmic ray origin.**—*Authors' abstract.*

11.10–137 551.521.64:574.6

Simons, D. G. (*Aero Medical Field Lab., Holloman Air Development Ctr., New Mexico*), **Biological effects of primary cosmic radiation.** *International Astronautical Congress, Proceedings of the 7th Congress, Rome, 1956*, issued Rome, **1956.** p. 381–400. 15 refs. Italian, French, German and English summaries p. 381–382. **DLC** (TL787.I44)—Heavy primary cosmic particles constitute one of the potential hazards of Space Flight. More than 25 USAF Stratosphere balloon flights have carried biological specimens to altitudes above 30 km at geomagnetic latitudes above 55° for as long as 30 hrs. Experiments to detect indirect effects included comparison of pre- and post-flight performance ability and a longevity study. Experiments to determine effects upon specific identifiable tissues include study of tissue cultures, development effects, hair graying in black mice, and damage to brain cells. Streaks of gray hairs suggest radial spread of radiation effects 20 times predicted values. Other experiments indicate no somatic health hazard from 24 hour exposure to cosmic ray primaries. *Subject Heading:* **1. Biological effects of cosmic rays.**—*Author's abstract.*

11.10–138 551.521.64

Smith, J. A. and Duller, N. M. (*Dept. of Physics, Univ. of Missouri*), **Effects of pi meson decay-absorption phenomena on the high-energy mu meson zenithal variation near sea level.** *Journal of Geophysical Research*, Wash., D. C., 64(12):2297–2305, Dec. **1959.** 7 figs., table, 26 refs., 12 eqs. **DLC**—An approximate calculation of the ground-level high-energy mu meson intensities is presented, with curves showing peculiar maxima in the angular vicinity from about 55° to 75° with respect to the vertical at ground-level energies from about 60 bev

to 160 bev. The effects are explained in terms of well known pi meson decay-absorption phenomena high in the earth's atmosphere. *Subject Headings:* **1. Cosmic ray mesons 2. Cosmic ray variations at sea level.**—*Author's abstract.* Ⓢ

11.10–139 551.508.953:551.521.64

Standil, S. and Loveridge, W. D. (*both, Manitoba Univ., Winnipeg, Canada*), **Large crystal total absorption spectrometer.** *Review of Scientific Instruments*, N. Y., 30(10):931–933, Oct. **1959.** 4 figs., table. **DWB, DLC**—A total absorption scintillation spectrometer has been built primarily for the study of the neutral component of cosmic radiation. The high energies involved necessitate a large NaI(Tl) crystal (−70 lb) completely surrounded by an efficient anticoincidence shield. The design and performance of this instrument are discussed. *Subject Headings:* **1. Spectrometers 2. Cosmic ray instruments.**—*Authors' abstract.* Ⓢ

2. IONOSPHERE

See also: **Field anomalies due to solar eruptions** (Lauter, Třiska), 11.10 47; **Geomag., auroral, ionosph. and cosmic-ray disturbances and solar activity** (Mariani, Molina), 11.10–178; **Magnetic separation of auroral particles** (Shaw), 11.10–185; **Auroral, geomagnetic and ionospheric disturbances** (Vestine), 11.10–186; **Low-energy corpuscular rad. at high alt.** (Cole), 11.10–319; **Ionospheric thermal radiation at R.F. in auroral zone** (Dowden), 11.10–324; **Wind systems for geomagnetic field** (Maeda), 11.10–342.

11.10–140 551.510.535:551.594.12

Bibl, K., **Sur le mécanisme d'ionisation de la couche sporadique Es de l'ionosphère.** [The ionization mechanism of the sporadic Es layer of the ionosphere.] *Annales de Géophysique*, Paris, 16(1):148–151, Jan./March **1960.** 8 figs., 6 refs. **DLC**—Using a new technique of observation it could be shown that the height of Es varies in a systematic way during an Es event. It has been possible to show that for most of the Es events the ionization altitude varies in the course of time. The ionization occurs at a higher altitude at the beginning and the end of each phenomenon. The ionization altitude is a monotonous function of its intensity; the altitude decreases if the ionization intensity increases. Simultaneously with the occurrence of an Es ionization, one often observes a considerable variation of the F ionization; this is particularly marked for height variations. In the case of an exceptionally strong Es ionization one often observes that the F ionization is dispersed towards the high altitudes; it afterwards reappears from the upper altitudes. These results have enabled to elaborate a model for the distribution of the electron density as a function of the maximum ionization intensity. The mechanism of the ionization increase in conjunction with an altitude decrease is similar to what is observed for the F2 layer; but the depression variation, and the hypothesis of an ionization in thin layers do not explain this mechanism in the Es layer. Only the hypothesis of a variable "range" of the ionization source appears acceptable. *Subject Headings:* **1. E layer ionization 2. Ionization height variations.**—*A. V.* Ⓢ

11.10–141 551.510.535

Bowman, G. G. (*Univ. Queensland, Brisbane*), **A relationship between spread-F and the height of the F2 ionospheric layer.** *Australian Journal of Physics*, Melbourne, 13(1):69–72, March **1960.** 5 figs. **DLC**—The variation, throughout the night, of range-spreading spread-F widths, at Brisbane, is investigated. Evidence is presented to support the hypothesis that the ripple amplitude of the spread-F ionospheric irregularities varies directly with the layer height. This leads to an association between the range-spreading width and the height of the layer. Certain aspects of frequency-spreading are also discussed. *Subject Heading:* **1. Spread F variations.**—*Author's abstract.* Ⓢ

11.10–142 551.590.24:551.510.535

Bowman, G. G. (*Univ. Queensland, Brisbane*), **Sunrise and eclipse effects on the ionosphere at Brisbane.** *Australian Journal of Physics*, Melbourne, 13(1):52–68, March **1960.** 17 figs., 4 tables, 8 refs. **DLC**—A rotating spaced-loop direction-finding system, located at Brisbane, has been operated to investigate sunrise effects by using pulsed 3.84 Mc/s transmissions, (a) at

normal incidence and (b) at oblique incidence. For oblique-incidence recording the transmitter was located at Armidale (bearing 202° and distant 355 km from Brisbane). Evidence is presented which suggests the formation (at both E and F2 layer levels) of several frontal irregularities, spaced some tens of kilometers apart, extending in directions parallel to the sunrise line and travelling, relative to the earth, with this line. These fronts pass overhead at Brisbane approximately halfway between the 90 km level and ground level sunrise times. In the post-sunrise period, F2 layer spreading on the two-hop trace appears, and the spreading width increases for about 2 hr, suggesting an F2 layer ripple structure, with increasing ripple amplitude. The post-sunrise sporadic E occurrence suggests frontal irregularities, lying close to the sunrise line direction, soon after sunrise, but indicates a swing in direction as time progresses. Rotating-loop normal-incidence transmissions were also used to investigate effects due to an eclipse of the Sun, at Brisbane, on April 8, 1959. Post-eclipse E and F2 layer frontal irregularities, oriented in directions close to the line representing the end of eclipse in the region of Brisbane, suggest a mechanism operating as the eclipse ends, which is similar to that operating at sunrise. The possibility, that the ripple structure which produces night-time spread F at Brisbane is generated at sunrise, is discussed. *Subject Headings:* **1. Sunrise effects on ionosphere 2. Ionospheric variations 3. Solar eclipse effects on ionosphere 4. Brisbane, Australia.**—*Author's abstract.* Ⓢ

11.10–143 551.508.96:535.51:621.396.8

Carlson, H. N., **Instrumentation for the determination of ionospheric polarization between 100 and 1,000 kc/s and preliminary data.** Pennsylvania. State University. Ionosphere Research Laboratory, Contract AF 19(604)-3875, Scientific Report No. 129, Feb. 1, **1960.** 38 p. 16 figs. (incl. photos), 10 refs., eqs. **DWB**—Equipment is described that receives ionospheric echoes over the swept range of radio frequencies 50–1000 kc/s and resolves them into their two circular components. This is accomplished by phase shifting and adding at a constant intermediate frequency. Circuits are designed for fast recovery since operation near the transmitter is necessary for RF tracking. Preliminary results are presented. *Subject Headings:* **1. Ionospheric measuring equipment 2. Radio wave polarization.**—*Author's abstract.* Ⓢ

11.10–144 551.510.535:551.510.62:621.396.8

Ellis, G. R. A. (*C.S.I.R.O. Upper Atmosphere Sec., Camden, N. S. W., Australia*), **Gyro splitting of ionospheric echoes.** *Journal of Atmospheric and Terrestrial Physics*, N. Y., 18(1):20–28, April **1960.** 8 figs., 2 tables, 9 refs. **DLC**—The propagation of extraordinarily polarized waves in the ionosphere is discussed. It is shown that the properties of highly retarded F region echoes sometimes observed at frequencies just below the gyro-frequency may adequately be explained if they are caused by the reflection of the X-wave at the normal extraordinary reflection level. Anomalous M-type multiple echoes and the mixed polarization of the echoes previously observed which had led to other explanations are interpreted in terms of mode change as a result of coupling in the E region. The analysis shows that the zenith angle of arrival of the gyro echoes is not zero and increases as the gyro-frequency is approached. Observations of gyro echoes at frequencies up to 1.51 Mc/s are described. It is found that there is a strong correlation between the occurrence of gyro echoes above 1.45 Mc/s and of sporadic E echoes. *Subject Headings:* **1. Ionospheric radio wave propagation 2. Radio wave polarization 3. Sporadic E layer.**—*Author's abstract.* Ⓢ

11.10–145 551.510.535:551.594.12

Eyfrig, Rudolf, **Zur Frage des Kontinental-Effektes der F2-Schicht.** [Continental effect upon the F2 layer.] *Geofisica Para e Applicata*, Milan, 44:179–187, Sept./Dec. **1959.** 10 figs., 7 refs. German and English summaries p. 179. **DLC**—Results from Russian stations prove the existence of a «Continental effect», on the maximum electron density of the F2-layer. In summer, in the interior of the asiatic continent a tendency exists for a higher concentration in daytime; on the other hand the so-called «evening concentration» is missing there. *Subject Headings:* **1. "Continental effect" on ionospheric electron density 2. Electron density in F2 region.**—*Author's summary.* Ⓢ

11.10–146 551.510.535:551.594.12:537.23

Farley, D. T., Jr. (*Cavendish Lab., Cambridge, England*), **A theory of electrostatic fields in the ionosphere at nonpolar geomagnetic latitudes.** *Journal of Geophysical Research*, Wash., D. C., 65(3):869–877, March **1960.** 9 figs., 7 refs., 28 eqs. **DLC**—The theoretical electrostatic coupling between the dynamo region and the F region of the ionosphere is examined at nonpolar geomagnetic latitudes. It is found that, under certain conditions, significant coupling between these two regions can occur at all latitudes, even for electrostatic fields with horizontal scale sizes as small as a few kilometers. The coupling is strongest at the poles and weakest at the equator. Strong coupling will also occur between magnetically conjugate portions of the F region, while weaker but significant coupling will exist between conjugate portions of the dynamo region. The strength of the electric source field which would be produced by an irregular, horizontally stratified wind in the dynamo region is then computed, both for polar and for nonpolar latitudes. The results indicate that, to a large extent, the polarization charge that the local winds attempt to build up leaks away vertically and forms closed current loops. In other words, the "internal impedance" of the thin source layer is greater than the "load impedance" presented by the rest of the ionosphere. Finally, the possibility that electrostatic fields may cause significant electron-density variations in the F region is examined briefly. It is concluded that they will not. *Subject Heading:* **1. Ionospheric coupling.**—*Author's abstract.* Ⓢ

11.10–147 551.510.535:523.164.3/4

Fredriksen, A. and Dyce, R. B. (*Stanford Res. Inst., Calif.*), **Ionospheric absorption investigations at Hawaii and Johnston Island.** *Journal of Geophysical Research*, Wash., D. C., 65(4):1177–1181, April **1950.** 7 figs., 3 refs. **DLC**—Measurements of ionospheric absorption by the cosmic-noise monitoring method show that, at certain tropical latitudes, an irregular component of absorption is often present in the evening hours. If the variable absorption is present at one observing site (Johnston Island), then variations are also likely to be present at another station about 1325 km away (Hawaii). The individual variations of absorption as a function of time are not correlated at the two stations, however, suggesting that the scale of the patches causing the absorption must be less than about 1000 km. An attempt is made to find a correspondence between hourly averages of the apparent absorption with other ionospheric parameters. Both nighttime and daytime absorption are observed. A greater nighttime component appears at Johnston Island than at Hawaii, implying the existence of a latitude dependence. Correlation with spread F or with sporadic E on the basis of ionosonde data from Maui was not found, although a correlation is apparent between cosmic-noise absorption and ionosonde minimum reflection frequency during geomagnetically quiet periods. There is good correlation between average hourly values of the absorption and F2 critical frequency foF2. This latter observation is explainable by the shielding effect of the F region. *Subject Headings:* **1. Ionospheric absorption calculation 2. Ionospheric absorption measurement techniques.**—*Authors' abstract.* Ⓢ

11.10–148 551.590.24:551.510.535:551.594.12

Gledhill, J. A. and Walker, A. D. M. (*both, Rhodes Univ., South Africa*), **The "Valley effect" in the interpretation of ionospheric eclipse records.** *Journal of Atmospheric and Terrestrial Physics*, N. Y., 18(1):61–64, April **1960.** 2 figs., 6 refs. **DLC**—It is shown that if a valley develops between the F1 and F2 layers during an eclipse it produces characteristic effects on the curves of electron density at fixed heights vs. time deduced from the ionograms. These curves show spurious maxima which are greatest at heights just above the valley and decrease with increasing height. The effects predicted correspond closely to those observed in South Africa during the eclipse of Dec. 25, 1954. *Subject Heading:* **1. Eclipse effects on ionospheric layers.**—*Authors' abstract.* Ⓢ

11.10–149 551.510.535:551.594.12

Gliddon, J. E. C. (*Queen Mary College, London*) and Kendall, P. C. (*Bedford College, London*), **Theoretical world curves of maximum ion density in a quiet F region.** *Journal of Atmospheric and Terrestrial Physics*, N. Y., 18(1):48–60, April **1960.** 14 figs., 8 refs., 19 eqs. **DLC**—The global variation of electron density in the F2 region is investigated on the assump-

tion of uniform temperature, uniform attachment-type law of recombination, a diffusion coefficient varying inversely as the density of neutral particles and a Chapman ionization law. Electron density is calculated as a function of altitude and of local time at a number of different latitudes for the equinox and solstices. World curves of maximum ion density are deduced and compared with MILLINGTON's curves. The curves presented here are "drawn out" in the east-west direction as appears to be the case with the corresponding curves obtained by ionosonde methods. Although the latter are plotted against the geomagnetic latitudes, this broad similarity seems to indicate that diffusion plays a significant part in the control of F2 ionization. *Subject Headings:* **1. Ionospheric electron density computation 2. Electron density in F2 region.**—*Authors' abstract.* Ⓢ

11.10–150 551.594.12:551.510.535

Herrinck, P. (*Service Météorologique du Congo Belge et du Ruanda-Urundi*), **Etude de l'évolution de la couche ionosphérique F2 à Léopoldville-Binza.** [Study of the evolution of the ionospheric F2 layer at Léopoldville-Binza.] *Annales de Géophysique*, Paris, 16(1):77–87, Jan./March **1960.** 6 figs., 2 tables, 5 refs. French and English summaries. **DLC**—The evolution of the maximum electron density in the F2 layer above Léopoldville-Binza presents the following peculiarities: 1) a semiannual global variation, in phase with the variation in magnetic activity; 2) a marked semiannual variation between 09 h and 23 to 02 hours U.T. and a marked annual variation for the remaining hours; 3) a considerable rate of increase with sunspot numbers between 18 and 24 hours LMT; 4) a maximum between 21 and 23 hours corresponding with a maximum of the half thickness; 5) a saturation effect between 07 and approx. 19 hours U.T., while for the other hours a practically perfect linearity with regard to the number of sunspots exists. Owing to the difficulties encountered in explaining these particularities merely by the action of photonic ionization and drift, it seems justified to consider extra ionization due to corpuscules accelerated in a region near to the earth. The hypothesis which is called for is to attribute the ionization of the F2 layer to a double photonic and corpuscular cause. *Subject Headings:* **1. Ionospheric electron density 2. Electron density in F2 layer 3. Ionospheric variations 4. Sunspot effects on ionosphere 5. Léopoldville-Binza, Belgian Congo.**—*A.V.* Ⓢ

11.10–151 551.510.535:551.510.62:621.396.1

Hoffman, W. C. (*Hughes Res. Labs., Reseda, Calif.*), **Conditions for the persistence of purely longitudinal or purely transverse propagation.** *Journal of Atmospheric and Terrestrial Physics*, N. Y., 18(1):1–7, April **1960.** fig., 4 refs., 26 eqs. **DLC**—The conditions for radio waves to propagate through the ionosphere exactly parallel or exactly transverse to the local direction of the centred-dipole-magnetic field are determined. The analysis is based on an appropriate form of the Haselgrove equations of ray-tracing in an inhomogeneous anisotropic medium, and the general forms of the refractive indices required for the persistence of purely longitudinal and purely transverse propagation are determined by integration of the Haselgrove equations. The resultant refractive indices do not appear to be appropriate to the ionosphere. *Subject Headings:* **1. Ionospheric radio wave propagation 2. Ionospheric radio wave refraction coefficients.**—*Author's abstract.* Ⓢ

11.10–152 551.510.535:621.396.8:523.746

Huang, Chun-Ming (*Radio Wave Res. Lab., Taipei, Taiwan, China*), **Some abnormalities in the variations of F2-layer critical frequency during the period of high solar activity of solar cycle 8–19.** *Journal of Geophysical Research*, Wash., D. C., 65(3):897–906, March **1960.** 16 figs., 2 tables. **DLC**—Some abnormalities in the variations of foF2 were observed at Taipei during the period of very high solar activity of solar cycle 8–19. They are the saturation effect of foF2 (i.e., the increasing rate of foF2 with respect to sunspot number is nearly zero at high solar activity), the occurrence of post-sunset peak of foF2, and the increase of foF2 during the ring eclipse. In this report variations of these phenomena are described, the close relationship existing among them is examined, and a probable explanation is given. *Subject Headings:* **1. Solar-ionospheric relationships 2. Ionospheric variations.**—*Author's abstract.* Ⓢ

11.10–153 551.510.535:621.396

†Koch, J. W., **Preliminary study of ionospheric cross-modulation at standard broadcast frequencies.** *U. S. National Bureau of Standards, NBS Report*, No. 6072, Sept. 25, **1959.** 12 p. 2 figs., 6 refs., 21 eqs. **DWB**—A preliminary study has been carried out to determine the approximate magnitude of ionospheric cross-modulation effects for a 750 kilowatt transmitter operating in the U. S. standard broadcast band. The study is based on simple theory and the presently available results of measurements which have been made in Europe. These considerations lead to a maximum expected cross-modulation of approximately five percent when the high-power transmitter is modulated at audio frequencies below 100 cps; at higher modulation frequencies the cross-modulation is reduced. Further experimental and theoretical work are needed for a more precise determination of cross-modulation as a function of frequency and path geometry. *Subject Heading:* **1. Ionospheric cross modulation.**—*Author's abstract.* Ⓢ

11.10–154 551.510.535:551.594.12:551.594.5:550.38:621.396.8

Matsushita, S. (*Geophysical Inst., Kyoto Univ. Japan*), **The morphology of the lower ionospheric region in auroral latitudes.** *Journal of Atmospheric and Terrestrial Physics*, London, 15(1/2):68–72, Sept. **1959.** 2 figs., 18 refs. **DLC**—Relations between blackouts, complete blanketing of F2 by abnormal-E, slant-Es and geomagnetic bay are described. Correlations between lower ionospheric and geomagnetic phenomena were obtained. Two types of absorbing regions, formed by x-rays generated from auroral particles, are described. Ionograms and magnetograms at College and Point Barrow, Alaska were used during a year starting March, 1955. Es distributions and examples of complete blanketing of F2, gradual blackouts, and slant-Es, with variations foF2, f-min F, fEs and f-min. and of geomagnetic horizontal components are shown on the diagrams. *Subject Headings:* **1. Ionospheric anomalies 2. Auroral ionization of E layer 3. Geomagnetic effects on ionization.**—*O.T.* Ⓢ

11.10–155 551.510.535:551.510.62:621.396.1

Murty, Y. S. N. and Khastgir, S. R., **Group refractive index of the ionosphere at low frequency.** *Journal of Atmospheric and Terrestrial Physics*, N. Y., 17(4):309–314, Feb. **1960.** 4 refs., 28 eqs. **DLC**—A general expression is obtained for the group refractive index for low-frequency radio wave propagation in the ionosphere. It is shown that, in the limiting case when electron collisional frequency is small, this expression for the group refractive index is identical with the approximate expression obtained by GIBBONS and RAO. *Subject Headings:* **1. Ionospheric radio wave refraction coefficients 2. Refractive index.**—*Author's abstract.* Ⓢ

11.10–156 551.510.535:551.510.62:621.396.1

Murty, Y. S. N. (*Defence Science Organization, Delhi, India*) and Khastgir, S. R. (*Univ. Calcutta*), **Polarization parameters of the downcoming radio wave.** *Journal of Geophysical Research*, Wash., D. C., 65(5):1449–1457, May **1960.** table, 21 refs., 20 eqs. **DLC**—The phase difference between the normal and the abnormal components of the magnetic vector of the radio wave (i.e., the components in and at right angles to the plane containing the wave normal and the direction of the earth's magnetic field) and the limits of the tilt angle of the major axis of the polarization ellipse (traced out by the electric vector) measured anticlockwise with respect to the direction of the magnetic north for the ordinary and the extraordinary modes of propagation have been obtained on the ray theory of propagation through the ionosphere. The values are given in a table for the ordinary and the extraordinary modes in both the hemispheres for regions below and above the level of ionospheric reflection. SCOTT's treatment of the same problem on the ray theory and the results given by ROY and VERMA on the basis of the coupled wave equations of SAHA and others are reviewed. It is shown that the discrepancies in the results of the polarization parameters obtained by different workers on ray theory are only apparent and arise out of the differences in the forms and notations used in the different formulas. It is also shown that the discrepancies in the limits of the major axis of the polarization ellipse obtained from the ray theory and the wave theory are due to the interchange in the expressions for the amplitude ratio of the normal to the abnormal components for the ordinary and the extraordinary waves given by SAHA and others. The experimental results of ROY and VERMA are shown to confirm our theoretical conclusions

about the limits of the tilt angle of the polarization ellipse. *Subject Heading:* **1. Radio wave polarization.**—*Author's abstract.* Ⓢ

11.10–157 551.510.535:550.385.4(98/99)

Sato Teruo (*Japan Defence Agency*), **Morphology of the ionospheric F2 disturbances in the Polar region.** *Japan. Science Council. Ionosphere Research Committee, Report of Ionosphere and Space Research in Japan*, 13(2):91–104, 1959. 10 figs., table, 16 refs. **DLC**—A study is made of the morphology of the F2 disturbance in the polar region (polar cap and auroral region) associated with geomagnetic storms, using the IGY ionospheric data from July 1957 to Feb. 1958. An analysis is made of individual severe geomagnetic storms, especially of five great storms which occurred in Sept. 1957 and Feb. 1958, and the statistical characteristics are also shown. The results are as follows: (i) The variations of the foF2 over the polar region start at nearly the same time as, or within a few hours after, the time of the sudden commencement of the geomagnetic storm. They take place even near the magnetic pole, and near the geographic pole in winter. (ii) The disturbance variations are most severe on the first day, continue during several days and cease with the decreasing geomagnetic activity. The type of variations are similar throughout the latitudes. (iii) The maximum depression of the foF2 comes at or after noon and recovers at night in winter and equinox, but the maximum seems to disappear in summer. (iv) The amplitude of the maximum depression is greatest in winter, and smaller in the polar cap than in the auroral zone. But it must be noted that the percentage of the depression is nearly the same in each season. (v) The disturbance in the polar cap seems to be simply the transfer of that in the auroral zone. *Subject Headings:* **1. foF2 disturbances 2. Polar magnetic storms 3. Magnetic effects on ionosphere.**—*Author's abstract.* Ⓢ

11.10–158 551.570.535:551.594.13

Schlapp, D. M. (*Univ. College of North Staffordshire*), **An attempt to measure the collision frequency of electrons in the F-region of the ionosphere.** *Journal of Atmospheric and Terrestrial Physics*, N. Y., 17(3):246–253, Feb. 1960. 4 figs., 7 refs., 2 eqs. **DLC**—An attempt was made to measure the collision frequency (v) of electrons in the F region of the ionosphere by APPLETON'S method of observing changes in the logarithmic reflection coefficient $\log p$ associated with changes ($\Delta P'$) in the group path, and using the expression $\Delta \log p = -\frac{v}{2c}(\Delta P' - \Delta P)$. It is shown that the experimental results were very variable and that the average of a large number behaves in a way which is not in accord with theory. It is concluded that, in the F-region, v is less than about 5×10^3 sec^{-1} but that no reliable estimates of its magnitude can be made by this method. *Subject Headings:* **1. Electron collision frequencies 2. F layer.**—*Author's abstract.* Ⓢ

11.10–159 551.510.535:551.510.62:621.396.1

Silberstein, R., **High frequency anti-multipath investigation.** *U. S. National Bureau of Standards, NBS Report*, No. 6040, March 2, 1959. 19 p. 3 figs., 3 tables, 14 refs., 6 eqs.—The objective of this investigation, begun in March 1958, was to design, furnish and test anti-multipath equipment that will minimize the severe multipath errors. The problems and assumptions associated with the error sources are analyzed in this report. The author presents a method of determining the error rate from ratio of desired and undesired signal power as well as the results of the analysis of ionospheric error sources. Attenuation factors such as ionospheric absorption, distance, and ionospheric focusing and antenna patterns may simulate a drop or increase of ion distribution and density in the F layer as revealed in this communication. *Subject Headings:* **1. Ionospheric radio wave propagation 2. Anti-multipath equipment.**—*N.N.* Ⓢ

11.10–160 551.510.535:551.594.13

Tsuda, Takao (*Dept. of Electronics, Kyoto Univ.*), **The motion of irregularities in the ionosphere.** *Japan. Science Council. Ionospheric Research Committee, Report of Ionosphere and Space Research in Japan*, 13(1):56–61, 1959. 3 refs., 8 eqs. **DWB, DLC**—An analysis is

made to discover the mean velocity of electronic density irregularities in the ionosphere by help of the simple turbulence theory. As the kinematic viscosity is much smaller than the magnetic diffusivity in the ionosphere, all the spontaneous electromagnetic field may be neglected. Under the influence of the terrestrial magnetic field and applied electric field, the movement of irregularities is concluded to be similar to that of the neutral wind in the E-region. *Subject Headings:* **1. Ionospheric electron density distribution 2. Ionospheric movements.**—*Author's abstract.* Ⓢ

11.10–161 551.510.535:551.594.13:550.388.2(52)

Tsukamoto, Kenichi and Ogata, Yoshiharu (*Radio Research Lab., Kokubunji*), **Ionospheric drifts at Yamagawa in Japan.** *Japan. Science Council. Ionospheric Research Committee, Report of Ionosphere and Space Research in Japan*, Vol. 13, No. 1:48–55, **1959.** 5 figs., table, 4 refs. **DWB, DLC**—IGY ionospheric drift measurement has been made at Yamagawa (Lat. 31°12.5′N. Long. 130°37.7′E.) in Japan, using the closely-spaced receiver fading method. The results of observations for about one year from Aug. 1957 are preliminarily analyzed. Discussions are given of the drift speed, diurnal variation of the drift vector and relationship between the drift speed and geomagnetic activity. *Subject Headings:* **1. Ionospheric drift measurements 2. Magnetic effects on ionosphere 3. Yamagawa, Japan.**—*Authors' abstract.* Ⓢ

11.10–162 551.510.535:551.594.13

White, M. L. (*Nat. Bur. of Stands., Boulder, Colo.*), **Thermal and gravitational atmospheric oscillations—ionospheric dynamo effects included.** *Journal of Atmospheric and Terrestrial Physics*, N. Y., 17(3):220–245, Feb. **1960.** fig., table, 25 refs., 83 eqs. **DLC**—The resonance theory of gravitational and thermal oscillations in a rotating atmosphere composed of a neutral gas (Sen and White, 1955; White, 1956) is extended to include an electron and positive ion gas with a permanent magnetic field superposed (so-called dynamo effect, Chapman and Bartels, 1940). Basic equations of energy and motion are given, resulting, for example, in a Kirchhoff's voltage law for the upper atmosphere. Height dependent expressions are obtained for the electric field, the current density, the ion drift velocities and non-linear heat source functions $\bar{q}_w\bar{q}_n$ for the gas-as-a-whole and the neutral gas component. The $\bar{q}$-functions are produced by an I^2R power loss. The conditions under which one obtains the previous time-independent differential wave-equation of Wilkes (1951) and Sen and White (1955) are discussed; as an example, it is required that the thermal source function $\overline{Q}$ include a $\bar{q}$ function, resulting in two coupled wave-equations, one for the gas-as-a-whole and another for the neutral component. Using a method of operators, a time-dependent differential wave-equation is obtained from the time-independent wave-equation. It is found as a sufficient condition that if the four independent space and time variables in the non-linear $\bar{q}$-term are separable [with further minor restrictions], then the oscillations satisfy the condition for neutral stability. Finally, a non-equilibrium "solution" for formation of ionized layers, based on the electron continuity equation, "tidal" transport terms included, is illustrated, using a method of successive approximation. Cavendish tables (Thomas and Robins, 1955) of the daily electron density variations at given true heights and the New York University analysis (Kertz, 1956) of the daily surface pressure variations are examined for predicted non-linear effects. One interesting consequence is an explanation of the major contribution to the 6 hr surface pressure variation as a self-coupling of the important 12 hr pressure variation. *Subject Headings:* **1. Ionospheric dynamics 2. Atmospheric oscillations 3. Dynamo theory of ionosphere.**—*Author's abstract.* Ⓢ

11.10–163 551.510.535:551.594.13

*Wright, J. W. and Fine, L. A., **Mean electron density variations of the quiet ionosphere, April 2, 1959.** *U. S. National Bureau of Standards, Technical Note*, No. 40-2, Feb. **1960.** 50 p. tables, 5 refs., numerous charts. **DWB** (M(055) U585te)—The CRPL has initiated a program for large-scale computation of electron density profiles from ionospheric vertical soundings. Scaling is performed at field stations permitting computation of hourly profiles at the central laboratory. These profiles are combined to form hourly mean quiet profiles for each station and month. The results of this program for the month of April are illustrated graphically. This report is the second of a series illustrating the electron density variations in the mean

quiet ionosphere between latitudes 15°N and 50°N along the 75°W meridian. *Subject Heading:* **1. Ionospheric electron density variations.**—*Author's abstract.* Ⓢ

3. AURORAS

See also: **Morphology of lower ionosphere in auroral latitudes** (Matsushita), 11.10–154; **Microstructure of geomagnetic field disturbance in auroral zone** (Egeland), 11.10–197; **X-rays in auroral zone** (Anderson), 11.10–217; **Aurora, radiation belt and solar wind** (Rees, Reid), 11.10–219; **Ionospheric thermal radiation at R.F. in auroral zone** (Dowden), 11.10–324.

11.10–164 551.594.51:546.11:535.33

Bagariatskiĭ, B. A., **O dopplerovskikh konturakh i krivykh raspredeleniia iarkosti dlia vodoroda v poliarnykh siianiiakh.** [Doppler contours and brightness distribution curves for hydrogen in auroras.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofizich.*, No. 6:858–864, **1959.** 20 refs., 22 eqs. Russian summary, p. 858. **DLC**—Formulas for curves of distribution of brightness and of Doppler contours of hydrogen emission in the aurora are derived on the assumption of a monoenergetic bundle of protons. The interval expressions for the curves of brightness in the zenith contour coincide with those obtained previously (Chamberlain, *Astrophysical Journal*, 120, 566, **1954** and A. Omholt, *Journal of Atmospheric and Terrestrial Physics*, 9, 18, **1956**) in the case of corresponding accuracy of the function of angular distribution of protons $N(\theta)$. The formula for the distribution of brightness of emission with height is

$$E_1(\xi) = 2\pi \int_{\theta_2}^{\theta_2} N(\theta) I[u(r)](du/dr) \sin\theta \, d\theta$$

The derivation of a formula for zenithal and horizontal contours from the fundamental equation

$$\Gamma = \int_0^{\xi_0} \int_0^{2\pi} \int_0^{\max} N(\theta\varphi) I[u(r)](du/dr) \sin\theta \, d\xi d\varphi d\theta$$

is illustrated. *Subject Headings:* **1. Auroral luminosity curves 2. Doppler displacement of auroral hydrogen lines.**—*I.L.D.* Ⓢ

11.10–165 551.594.5:535.33

Bless, R. C. (*Univ. Wisconsin*), Gartlein, C. W. and Sprague, G. (*both, Cornell Univ., Ithaca, N. Y.*), **Some spectral studies of the aurora.** *Journal of Geophysical Research*, Wash., D. C., 65(2):565–570, Feb. **1960.** 3 figs., 2 tables, 12 refs., 5 eqs. **DLC**—Some results of spectral studies of the aurora are discussed. The spectra, taken routinely since 1941, give a continuous spectral record of the north sky for every night. Special emphasis was given the study of hydrogen, with two main results; hydrogen appears in the early part of an aurora, and may be gone before the visual display is over; the absolute intensity of an aurora increases as the aurora expands outward from the pole. Sample intensity measurements are given showing the time variation of various components. *Subject Headings:* **1. Auroral spectra 2. Hydrogen lines.**—*Author's abstract.* Ⓢ

11.10–166 551.594.5

Davis, T. Neil and Kimball, Donald S., **Incidence of auroras and their north-south motions in the northern auroral zone.** Alaska. Univ. Geophysical Institute, Grant NSF Y/22.6/327, Scientific Report No. 4, Jan. **1960.** 19 p. 12 figs., 8 refs. **DWB**—Studies of the incidence of auroral forms and their north and south motions are made by using a close-spaced array of all-sky cameras located in the northern auroral zone at the approximate geomagnetic longitude 250°E. It is found that during the observing season 1957–58 the peak of the average auroral zone occurred at 66–67° geomagnetic latitude. Although the southern extent of auroras retreats northward after local magnetic midnight, the southward motion of the individual forms, observed at the southern edge of the auroral zone, predominates over the northward motion throughout most of the night. The data indicate the existence on any given night of a latitude position near which many auroral forms occur. The first motion of

auroras incident north of this position tends to be northward, and the first motion of auroras incident south of this position tends to be southward. A curve showing the occurrence of auroral forms peaks at, and is nearly symmetrical about, local geographic midnight but the intensity of auroral emissions measured over the celestial hemisphere remains at a high level after midnight. *Subject Headings:* **1. Auroral forms 2. Auroral latitude.**—*Author's abstract.* Ⓢ

11.10–167 551.594.5:621.396.8

Dowden, R. L. (*Commonwealth Ionos. Prediction Serv., Hobart, Tasmania*), **Low-frequency (100 kc/s) radio noise from the Aurora.** *Nature*, London, 184(4689), Supp. No. 11:803, Sept. 12, 1959. 7 refs. **DWB**—A report of "hiss" observations carried out at Hobart, Tasmania. Five frequency channels were operated simultaneously, covering the gap from the normal "hiss" frequencies to the controversial 100 kc/s band. The center frequencies of these channels were 4.6, 9.6, 27, 70 and 180 kc/s. The observations establish that "hiss" can sometimes occur at frequencies up to 180 kc/s, at least, suggesting that extraterrestrial noise much below a megacycle might be a "hiss" rather than "cosmic noise." *Subject Headings:* **1. Aurora emissions 2. Radio noise from auroras.**—*I.S.* Ⓢ

11.10–168 551.594.5:621.396.8

Duncan, R. A. and Ellis, G. R., **Simultaneous occurrence of sub-visual aurorae and radio noise bursts on 4.6 kc/s.** *Nature*, London, 183(4675):1618–1619, June 6, **1959.** 3 figs., 1 table, 3 refs. **DLC**—Observations at Camden, near Sydney (geom. lat. 42°S) of enhanced emission toward the south of the red oxygen (6300 A) airglow are interpreted as sub-visual aurorae. Simultaneous radio noise at 4.6 kc/s show a definite correlation, both related to magnetic disturbance and tending to occur when the disturbance index (K)>5. The one can occur without the other and is explained. *Subject Headings:* **1. Auroral emissions 2. Radio noise from auroras.**—*W.N.* Ⓢ

11.10–169 551.594.5:779

Evans, S. (*Scott Polar Res. Inst., Cambridge*), **Horizontal movements of visual auroral features.** *Journal of Atmospheric and Terrestrial Physics*, N. Y., 16(1/2):191–193, Oct. **1959.** 2 figs., 2 refs. **DWB, DLC**—A simple investigation of comparable visual movements using time-lapse photographs, is attempted. The material used was obtained at Royal Society Base, Halley Bay, Antarctica, during the southern winter 1956. The method applied is explained and illustrated by two graphs. *Subject Headings:* **1. Auroral photographs 2. Visual observation of auroras.**—*O.T.* Ⓢ

11.10–170 551.594.5:621.396.8

Forsyth, P. A. (*Univ. Saskatchewan*), **On the geometry of radio reflections from aurora.** *Canadian Journal of Physics*, Ottawa, 38(5):593–603, May **1960.** 5 figs., 15 refs. **DWB, DLC**—By assuming that auroral radio reflections are produced by volume scattering in clouds of ionization having the same spatial configuration as the visible auroral structures, and by taking into account the radar pulse duration and antenna beam width, it is possible to predict the probability of echo occurrence as a function of range and azimuth. This echo distribution is quite similar to that observed experimentally even when "aspect sensitivity" of the individual scatterer is neglected. Unfortunately, the optical evidence is not sufficiently extensive to permit precise calculations to be made, nor the radio evidence to permit detailed comparisons, but previous estimates of the shape of the scattering structures that have been based on the azimuthal echo distribution without regard to the factors discussed here are likely to be seriously in error. *Subject Heading:* **1. Radio reflections from auroras.**—*Author's abstract.* Ⓢ

11.10–171 551.594.5:550.386.6

Gadsden, M., **Studies of the upper atmosphere from Invercargill, New Zealand, Pt. 5, The frequency of occurrence of auroras and its dependence on magnetic activity and temporal functions.** *Annales de Géophysique*, Paris, 16(1):88–104, Jan./March **1960.** 6 figs., 17 refs. **DLC**—The results of the analysis of twenty months' records from an all-sky camera are presented and discussed. (The all-sky camera has been operated at Invercargill, situated outside the southern auroral zone.) Correlation of the frequency of occurrence of auroras with mag-

netic K-index was found, and it has been established that the correlation, while not good, is better with local K-index than with planetary K-index. The seasonal variation of non-rayed forms has been found to show a significant maximum in January, with no significant variation through the rest of the year. No significant diurnal variation was found. No 27-day recurrences in either auroral or magnetic activity were found for the twelve months of the IGY, and there is no significant persistence of non-rayed auroras from day to-day. Rayed auroras tend to persist for one day. During the night, it was found that auroras commencing early in the night tended to persist through the night, even though the magnetic activity originally giving rise to the aurora did not persist. *Subject Headings:* **1. Auroral-magnetic relationships 2. K-index 3. Geomagnetic activity 4. Invercargill, New Zealand.**—*Author's abstract.* Ⓢ

11.10–172 551.594.51:535.33

Jones, A. Vallance (*Univ. Saskatchewan*), **An analysis of a spectrogram of the red aurora of Feb. 10/11, 1958, in the wavelength range 7300–8700 Å.** *Canadian Journal of Physics*, Ottawa, 38(3):453–457, March **1960.** 2 figs., table, 12 refs. **DWB, DLC**—A high-dispersion photographic infrared spectrum covering the 7300–8700 Å region was obtained from the great red aurora of February 10/11, 1958. This spectrum shows the λλ7774 and 8446 OI lines to have been enhanced at least five times relative to normal aurora. The most striking feature of the spectrum was the appearance with high intensity of the forbidden $^2D - ^2P$ multiplet of OII. The measured wavelengths and relative intensities of the features of the spectrum are listed. *Subject Headings:* **1. Auroral spectra 2. Red auroral lines.**—*Author's abstract.* Ⓢ

11.10–173 551.594.51:535.33:546.17

Jones, A. Vallance and Hunten, D. M. (*both, Univ. Saskatchewan*), **Rotational and vibrational intensity distribution of the first negative N_2^+ bands in sunlit auroral rays.** *Canadian Journal of Physics*, Ottawa, 38(3):458–476, March **1960.** 7 figs., table, 35 refs., 11 eqs. **DWB, DLC**—Spectra of sunlit auroral rays were obtained from Saskatoon during the auroras of September 3/4 and 4/5, 1958. The resolution of these spectra was sufficiently high to enable measurements to be made of the relative intensities of the lines of the 0–0 first negative N_2^+ band as well as the relative intensities of bands of the $\Delta v = -1$ sequence of this system. An analysis of the rotational line intensities shows they are consistent with an excitation process in which N_2^+ ions in thermal equilibrium with the atmosphere at 2200°K fluoresce under the influence of solar radiation. The vibrational intensity distribution also is consistent with a fluorescent excitation from a state of thermal equilibrium at about 2050°K. It is shown that the results are not consistent with a fluorescent excitation process in which the rotational and vibrational degrees of freedom of the N_2^+ ions come into radiative equilibrium with the solar radiation. Earlier conclusions that radiative equilibrium did hold for vibration are shown to be in error as a result of the high rotational temperature and the low dispersion used. It is concluded that the destruction of N_2^+ ions as a result of dissociative recombination proceeds sufficiently fast to prevent any significant approach to radiative equilibrium. This investigation provides a strong indication that the kinetic temperature of a sunlit auroral ray (perhaps in the 400–500 km region) is in the neighborhood of 2000°K. This may be somewhat higher than the temperature of the normal atmosphere at this height. *Subject Headings:* **1. Sunlit auroral spectra 2. Auroral nitrogen bands 3. Auroral temperatures.**—*Authors' abstract.* Ⓢ

11.10–174 551.594.5:550.3:061.3(438)

Kosibowa, Stefania (*Wrocław*), **Polish visual observations of aurorae in 1958 within the framework of IGY.** *Acta Geophysica Polonica*, Warsaw, 7(2):198–216, **1959.** table. Polish summary, p. 216. **DWB, DLC**—Visual observations of auroras in 1958 are tabulated. The participants in these observations were two observatories of the Institute of Geophysics, Polish Academy of Sciences, 3 astronomical observatories, 15 stations of the Hydrometeorological State Institute, over 50 amateur observers and, in the period Feb. 8 to April 12, one outpost of the company "Polskie Ratownictwo Okretowe." All the observations were made in the subauroral belt, except those made at the outpost which was situated in the auroral zone. Three strong auroral displays were observed in Poland during 1958. All the auroras were associated with magnetic storms. Other details of Polish auroras are discussed. *Subject*

Headings: **1. Visual observation of auroras 2. IGY aurora program 3. Polish participation in IGY 4. Auroral-magnetic relationships.**—*I.S.* Ⓢ

11.10–175 551.594.52

Lassen, Knud (*Danish Met. Inst., Copenhagen*), **Existence of an inner auroral zone.** *Nature*, London, 184(4696):1375-1377, Oct. 31, **1959.** 4 figs., 12 refs. **DWB**—The existence of an inner auroral zone at a Polar distance of 5–10° is described. The article also gives an account of auroras which form the inner auroral zone. The auroral observations in 1952–56 at Godhavn show that diurnal distribution of auroral frequency had two maxima. There are two types of distribution, one with a maximum near magnetic midnight and the other formed by zenithal aurora. The evening type auroras are related to magnetic activity while the morning types are not. *Subject Headings:* **1. Auroral zones 2. Auroral frequencies 3. Auroral-magnetic relationships.**—*A.H.K.* Ⓢ

11.10–176 551.594.5

Leipnitz, H., **Nordlichtbeobachtung am 4.9.1958 in Olbersdorf/Sa.** [Aurora observed on Sept. 4, 1958 at Olbersdorf/Sa.] *Zeitschrift für Meteorologie*, 13(7/8):196-197, July/Aug. **1959. DWB, DLC**—The several phases of the aurora, as observed at the Meteorological Station, Olbersdorf über Zittau, from 1935h to 2310h are described. *Subject Headings:* **1. Auroral descriptions 2. Olbersdorf, Germany.**—*O.T.* Ⓢ

11.10–177 551.594.5:535.33:546.17

Lytle, E. A. and Hunten, D. M. (*both, Univ. Saskatchewan*), **Dawn enhancement of auroral N_2^+ emission.** *Canadian Journal of Physics*, Ottawa, 38(3):477–481, March **1960.** 3 figs., 11 refs. **DWB, DLC**—The 0–0 band at 3914 Å was observed once per minute with a scanning spectrometer as sunlight illuminated the upper atmosphere on the morning of September 5, 1958. It is reasonable to assume that the density of N_2^+ ions was maintained constant during this time, and that the observed rise of intensity was due to resonance scattering of sunlight. The ions were found to be distributed between 180 and 320 km with peak at 250; density here was 12×10^4 ions/cm^3. There was some evidence for another layer at 120 km. Rotational temperatures measured while the main layer was fully illuminated agreed well and gave an average of 1060±100°K. *Subject Headings:* **1. Auroral nitrogen bands 2. Auroral emissions.**—*Authors' abstract.* Ⓢ

11.10–178 523.74:551.594.5:551.510.535:551.521.64:550.385.4

Mariani, F. and Molina, F. (*both, Inst. Nazionale di Geofisica, Rome*), **Perturbazioni geomagnetiche, aurorali, ionosferiche e dei raggi cosmici: interdipendenze e relazioni con l'attivita solare, Parte I, 1. Tempeste magnetiche.** [Geomagnetic, auroral, ionospheric and cosmic-ray disturbances: their relationships with each other and with solar activity, Pt. 1. [Ch.] 1, Magnetic storms.] *Annali di Geofisica*, Rome, 12(3):297-368, July/Sept. **1959.** 28 figs., table, 84 refs. English summary p. 365. Also **Parte I, 2, L'aurora Polare** [Pt. 1, [Ch.] 2, Polar auroras]. *Ibid.*, p. 389–437. 20 figs., 2 tables, 88 refs., eqs. English summary, p. 435. **DLC**—In the first chapter the observational facts concerning aurorae and geomagnetic, ionospheric and cosmic rays storms are described and discussed, also from the point of view of the reciprocal connection and their correlation with the solar activity. The morphology of the geomagnetic storms is discussed; the two components of the perturbation field, D_{st} and S_D, are described also in terms of electric current systems flowing in the ionosphere, and the meaning of S_D is illustrated. A brief description is made of the sudden commencements of geomagnetic storms, of their geographical distribution and diurnal variation. The last part of the first chapter deals with the relations between geomagnetic storms and solar activity. In the second chapter the main theories and hypotheses concerning the above phenomena are considered. Phenomenological aspects of polar aurorae, particularly their visual appearance, their geographical distribution and time variations, and the physical structure of auroral spectra, with particular regard to the effective causes of auroral phenomena are discussed. Last, the correlation of aurorae with solar and geomagnetic activity is considered. *Subject Headings:* **1. Auroral-geomagnetic relationships 2. Cosmic ray storms 3. Ionospheric storms 4. Magnetic storms and auroras.**—*Authors' abstract.* Ⓢ

11.10–179 523.164.82:551.594.5:550.385.4

Maxwell, A.; Thompson, A. R. and Garmire, G. (*all, Radio Astronomy Station of Harvard College Observatory, Fort Davis, Texas*), **The association of solar radio bursts with auroral streams.** *Planetary and Space Science*, N. Y., 1(4):325–332, Sept. **1959.** 4 figs., table, 10 refs. **DWB, DLC**—Slow drift (Type II) radio bursts from the sun are believed to be caused by a primary disturbance moving outward through the solar atmosphere with a velocity of about 1000 km/sec. Analysis of the 2 years, 1956 October 1 through 1958 September 30, over the sunspot maximum shows that 45 per cent of these bursts are associated with the subsequent occurrence of terrestrial aurorae and magnetic storms. The mean delay between the radio bursts and the terrestrial disturbances is 33 hr, which is in good accord with the velocity for the disturbing source is deduced from the radio data. Investigation of the properties of the individual slow drift bursts and their association with other solar radio and optical phenomena reveals no completely conclusive criteria to explain why only 45 per cent of the bursts are geomagnetically important. The geomagnetic effects are enhanced, however, if the bursts occur near the equinoxes and if they are accompanied by a flare of importance 2 or 3, or by continuum (Type IV) radiation. In the reverse association, with radio data available for an average 14 hr daily, it is shown that at least 60 per cent of magnetic storms are preceded, within 4 days, by a slow drift burst. *Subject Headings:* **1. Solar radio noise bursts 2. Solar effects on auroras 3. Solar-magnetic relationships.**—*Author's abstract.* Ⓢ

11.10–180 551.594.51:535.33

Muliarchik, T. M., **Interferometricheskie izmereniia shiriny linii λ5577 Å (OI) v poliarnykh siianiiakh.** [Interferometer measurement of the width of the λ5577 Å (OI) line in auroras.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geofiz.*, No. 12:1902–1903, Dec. **1959.** fig., 7 refs. **DWB, DLC**—The forbidden line of λ5577 Å (OI) in auroras where width is determined entirely by the Doppler effect serves as a means for studying the kinematic temperature at the level of illumination. Observations were carried out on this line during 1958–1959 at lat. 64°, long. 127° by means of an interferometer with glass plates having a multilayer dielectric cover. Intermediate rings of molten quartz 6.8 and 10 mm thick were used. Interference rings of line λ5570 Å KrI from a Krypton gas charge tube were imprinted several times during the exposure upon the same frame as 5577 Å. A typical photograph of line λ5577 Å (OI) is presented and analyzed. It is concluded that the temperature measured on the photograph of the λ5577 Å emission of an undisturbed night sky amounts to 260±35°K. This value exceeds the measurement of WORK and ARMSTRONG. It is possible that the difference is produced by the warming up of the upper atmosphere in high geographic latitudes. Such warming was observed also on the basis of measurements of the rotating temperature zone of OH. *Subject Headings:* **1. Forbidden [OI] lines 2. Auroral emissions 3. Auroral temperatures.**—*I.L.D.* Ⓢ

11.10–181 551.594.51:535.33

Muliarchik, T. M., **Interferometricheskoe izmerenie shirin emissiĭ λ6300 Å (OI) i λ5198–5200 Å (NI) v poliarnykh siianiiakh.** [Interferometer measurement of λ6300 Å (OI) and λ5198–5200 Å (NI) emissions from auroras.] *Akademiia Nauk SSSR, Doklady*, 130(2):303–306, **1960.** 4 figs., 7 refs. **DLC**—In this interferometric measurement of the forbidden emission of auroras individual emissions were separated by filters with transmission bands of 80–100 Å. Quartz interference rings 8 and 10 mm in diameter were used to photograph the red oxygen line. The interferometer was placed in a hermetically sealed chamber and both were placed in a heat-insulated box in which the temperature was maintained constant within ±0.5°C. Photographs of the interference rings of the λ6300 Å line (OI) and of the yellow krypton line and of the forbidden doublet of nitrogen λ5198–5200 Å and a photometric section of the internal λ6300 Å ring are presented. The temperatures determined from the width of the red line were between 1200 and 3400°K. The accuracy of all cases was ±15%. The mean temperature of these photographs was 1210±50°K. A tendency to increase in temperature with increase in illumination brightness was observed. In type A auroras there was a temperature of about 1500°K. When the intensity of line λ6300 Å was 2–5 kilo Rayleigh and 1700–2000°K with an intensity 5–15 kilo Rayleigh, the ratio of the intensities of the doublet components 5198–5200 Å was $I_{5200}/I_{5198}=1.7\pm0.1$. The temperatures determined

from the width of 5200 Å were 1850±250°K for the first photograph and 2,000±300°K for the second one. *Subject Headings:* **1. Forbidden [OI] lines 2. Auroral emissions 3. Auroral temperatures.**—*I.L.D.* Ⓢ

11.10–182 541.1:546.21:551.594.51

†Omholt, A., **Studies on the excitation of aurora borealis, Pt. 2, The forbidden oxygen lines.** *Geofysiske Publikasjoner*, Oslo, 21(1), Sept. **1959.** 38 p. 8 figs., 3 tables, bibliog., p. 36–38, 9 eqs. **DWB, DLC**—Excitation and deactivation of the forbidden oxygen lines is studied theoretically with emphasis on excitation by secondary electrons and discharge mechanisms. The computed value of the intensity ratio I(5577)/I(4709) for excitation by secondary electrons is of the same order of magnitude as observed in auroras. Discharge mechanisms are probably not able to contribute significantly to the auroral excitation, but the possibility that the horizontal currents responsible for the magnetic perturbations associated with auroras contribute to some extent cannot be dismissed. Other indirect excitation mechanisms and deactivation mechanisms for the excited atoms are briefly reviewed. The intensity ratio $I(5577)/I(4709)$ in auroras was measured with a photoelectrical photometer and found to be constant within ±25% in all the forms measured. Rapid fluctuations in the intensities of the green (OI) line and the First Negative N_2^+ bands have been studied and the lifetime τ of the $O(^1S)$ atoms has been computed by various methods. The lifetime appears to be 0.7±0.1 sec. The detailed interpretation depends on the true value of the lifetime of the undisturbed $O(^1S)$ atoms, but the available evidence suggests that collisional deactivation sometimes occurs, the lifetime of the undisturbed atoms being about 0.75 sec, and the probability of deactivation being in the range **0–1**/sec. This implies a probability of deactivation per gaskinetic collision of the order of magnitude 10^{-4}. The importance of the various excitation mechanisms is discussed in the view of the measured lifetimes. Excitation by secondary electrons seems to be consistent with the observations. The red doublet is briefly discussed. There are not necessarily any inconsistencies between theory and observations, but the relevant data are too inaccurate to justify detailed discussions and definite conclusions. New observations on auroras can yield only limited information until our knowledge about the basic processes is improved by theoretical or laboratory investigations. *Subject Headings:* **1. Aurora borealis 2. Excitation mechanisms 3. Auroral ionization.**—*Author's abstract.* Ⓢ

11.10–183 551.594.5(477)

Prokh, L. Z. and Iaremenko, L. N., **Nabliudeniia nad poliarnymi siianiiami na Ukraine.** [Observations of auroras in the Ukraine.] *Meteorologiia i Gidrologiia*, Moscow, No. 10:31, Oct. **1959. DWB, DLC**—Visual observations of Aurora Borealis were carried out since 1957 by 16 Hydrometeorological Stations in the Ukraine. The stations in the Crimea and Odessa also observed this phenomenon. Magnetic disturbances were not always accompanied with visual observations. *Subject Headings:* **1. Aurora borealis 2. Visual observation of auroras 3. Ukrainian S.S.R.**—*N.P.S.* Ⓢ

11.10–184 551.594.5:77:535.3

Sandford, B. P. and Heiser, P. (*both, Scott Base, Antarctica*), **Colour photography of the aurora.** *Nature*, London, 184(4685), Supp. No. 8:540, Aug. 15, **1959.** 2 refs. **DWB**—A test series of color photographs is reported as indicating that aurora australis can be photographed by a color film now available commercially. The test was made at Scott Base, in Antarctica during May and June, 1959. Super-Anscochrome daylight film (speed rating: 100 A.S.A.) was used in an all-sky camera with an F/14 lens, and exposure times of up to 2 min. *Subject Headings:* **1. Auroral photography 2. Aurora australis 3. Color photography.**—*I.S.* Ⓢ

11.10–185 551.510.535:551.594.13:550.388.8

Shaw, J. E. (*Ionospheric Prediction Service, Dept. of the Interior, Miller's Point, Sydney*), **Outline of a theory of magnetic separation of auroral particles and the origin of the S_D field.** *Planetary and Space Science*, N. Y., 2(1):49–55, Oct. **1959.** 4 figs., 14 refs. **DWB**—The diurnal variations of occurrence of two types of sporadic E-ionization at Macquarie Island (geomag. lat. 61.1°S) are identified with the diurnal variations of the flux of incoming protons and electrons. It is shown that protons and electrons which have been accelerated under the

control of the geomagnetic field will be separated by magnetic forces resulting from their motion along the curved geomagnetic lines of force. The resulting pattern of precipitation in the atmosphere explains qualitatively the regular diurnal features of the occurrence of sporadic E-ionization. An extension of the theory provides a basis for interpretation of the observed development of a visual auroral display, with particular reference to the mode of formation of visual auroral forms. The theory explains the origin of the field responsible for the S_D magnetic variations and is in agreement with the spiral occurrence of magnetic disturbance variations observed in the north polar regions by Meek. *Subject Headings:* **1. Auroral ionization of E layer 2. Auroral-magnetic relationships.**—*Author's abstract.* Ⓢ

11.10–186 551.594.5:551.510.535:550.385

Vestine, E. H. (*Rand Corp., Santa Monica, Calif.*), **Polar auroral, geomagnetic and ionospheric disturbances.** *Journal of Geophysical Research*, Wash., D. C., 65(1):360–362, Jan. **1960.** 5 refs., eq. **DWB, DLC**—The study refers to VESTINE and SIBLEY (1959) who noted that the integral invariant of auroral particle motion appears to predict features associated with auroral isochasms, when the geomagnetic field in space can be computed. The author suggests, that the application of the integral invariant may explain other polar effects. These include: 1) increased frequency and intensity of aurora near midnight, 2) the two polar electrojets associated with polar magnetic disturbances and radio blackouts, 3) the tendency of magnetic rays to recur near the same universal hour of time for several consecutive nights. *Subject Headings:* **1. Polar aurora 2. Magnetic storms and auroras 3. Ionospheric disturbances.**—*E.K.* Ⓢ

11.10–187 551.594.51:535.33

Wallace, L. and Chamberlain, J. W. (*both, Yerkes Obs., Univ. of Chicago, Williams Bay, Wisc.*), **Excitation of O_2 atmospheric bands in the aurora.** *Planetary and Space Science*, N. Y., 2(1):60–70, Oct. **1959.** 3 figs., 2 tables, 26 refs., 13 eqs. **DWB**—Spectra of the aurora show a wide disparity between the rotational temperatures of the two observed atmospheric bands, $b'\Sigma_g^+ \rightarrow x^3\Sigma_g^-$, with $T_{rot}(0\text{–}1) \approx 200°K$ and $T_{rot}(1\text{–}1) > 700°K$. As the rotational structure of the bands is not resolved, it is not absolutely certain that the temperature anomaly is real, but known features in the auroral spectrum would not produce the effect through blending. Fluorescence in the 0–0 band provides a possible but improbable explanation. Another alternative to explain the data is excitation of O_2 by energy transfer from $O(^1D)$ (upper term of the red lines) followed by vibrational deactivation. In the latter case the relative intensities of the O_2 bands from vibrational levels $v' \geq 1$, and predict virtually complete suppression of the (OI) red lines at 100 km in the airglow. The airglow O_2 emission gives $T_{rot}(0\text{–}1) = 183°K$. *Subject Headings:* **1. Auroral temperatures 2. Oxygen bands 3. Airglow spectrum theories.** —*Author's abstract.* Ⓢ

11.10–188 551.510.535:551.594.5:621.396.8

Yeh, K. C. (*Univ. of Illinois*) and Villard, O. G., Jr. (*Stanford Univ.*), **Fading and attenuation of high-frequency radio waves propagated over long paths crossing the auroral, temperate and equatorial zones.** *Journal of Atmospheric and Terrestrial Physics*, N. Y., 17(4):225–270, Feb. **1960.** 12 figs., table, 22 refs. **DLC**—This investigation is primarily concerned with the fading and attenuation of high-frequency radio signals propagated over a long path crossing the auroral zone. The fading of high-frequency signals propagated over non-auroral paths of comparable length has also been studied, and some new results are obtained. The principal fading and attenuation measurements on which these conclusions are based were carried out in August 1957. For the auroral paths, there is no diurnal variation in fading speed except for a distinct minimum in time interval 1330–1900 PST, during which time the fading speed has little apparent dependence on magnetic activity along the path. In other time periods a positive correlation between magnetic activity and fading speed is found. It is suggested that the period of minimum fading speed is a consequence of the existence at that time of the kind of propagation mode made possible by ionospheric tilts. Attenuation over the long auroral-zone path is found to be associated with 'polar blackouts' as indicated by the absence of returned echo in vertical sounders located along the path. The percentage association varies with the location of the station relative to the path. This variation is

consistent with the inferred propagation modes. It is found that during the hours 1330–1900 PST the attenuation cannot be attributed to the absorption that gives rise to blackouts as it can in the other hours. This is also explainable on the basis of the postulated tilt-mode propagation. Similar observations for temperate-latitude and transequatorial paths of comparable length indicate that there is strong diurnal variation in fading speed. Some plausible explanations are offered. *Subject Headings:* **1. Auroral effects on radio propagation 2. Ionospheric tilt 3. Polar blackouts.**—*Author's abstract.* Ⓢ

4. GEOMAGNETISM

See also: **Magnetic damping of satellite rotation** (Wilson), 11.10–35; **Mode theory propagation in presence of transverse magn. field** (Crombie), 11.10–51; **Yearbook for 1959** (France. Bureau des Longitudes), 11.10–61; **Magnetic field with great solar flare** (Howard et al.), 11.10–76; **Solar corpuscular streams** (Mustel'), 11.10–85; **Solar plasma instability** (Reiffel), 11.10–89; **Cosmic ray decreases preceding max. solar activity** (Legrand), 11.10–134; **Morphology of lower ionosphere in auroral latitudes** (Matsushita), 11.10–154; **Morphology of F2 disturbances in polar region** (Sato), 11.10–157; **Motion of irregularities in ionosphere** (Tsuda), 11.10–160; **Ionospheric drifts** (Tsukamoto, Ogata), 11.10–161; **Auroras and magnetic activity** (Gadsden), 11.10–171; **Geomag., auroral, ionosph. and cosmic-ray disturbances and solar activity** (Mariani, Molina), 11.10–178; **Solar radio bursts and auroral streams** (Maxwell et al.), 11.10–179; **Magnetic separation of auroral particles** (Shaw), 11.10–185; **Auroral, geomag. and ionospheric disturbances** (Vestine), 11.10–186; **Ring current and outer atmosphere** (Akasofu), 11.10–215; **Cosmical hydromagnetics and outer atmosphere** (Tamao), 11.10–220; **Surface pressure and geomag. disturbances** (Shapiro), 11.10–327; **Wind systems for geomag. S_d field** (Maeda), 11.10–342.

11.10–189 550.380.8

Blamont, J. F., **Mesure du champ magnétique terrestre par résonance magnétique.** [Geomagnetic-field measurement through magnetic resonance.] *Comité National Français de Géodésie et Géophysique, Comptes Rendus*, 1958, issued Paris, **1959.** p. 34–43. **DLC**—After recalling the principal magnetic properties of nuclei and the characteristics of protons existing in a magnetic field, the author shows that the measurement of the magnetic field can be based on magnetic resonance. The method consists in observing in a magnetic field the absorption or emission of an electromagnetic radiation whose frequency $w = 8H$, γ depending only on interatomic constants. When detecting this radiation, one can take the measurement of the magnetic field through measuring the frequency of the radiation provided that the invariable factor γ has previously been determined. The accuracy of magnetic field measurement depends on the precision (which is very great) of the frequency measurements. The examination of the resonance sharpness and the line intensity proves that magnetic resonance is the most accurate method for measuring fields. This measurement process permits to obtain absolute readings. However, the measurement of the geomagnetic field requires amplification of the signal, which cannot be achieved without disturbing thoroughly BOLTZMANN'S distribution. The free nuclear precision magnetometer (type VARIAN) and the polarization method through OVERHAUSER D'ABRAGAM and SOLOMON effect are two practical applications. *Subject Headings:* **1. Geomagnetic field measurement 2. Geomagnetic instruments 3. Magnetometers.**—*A. V.* Ⓢ

11.10–190 550.382:517.512.2

*Hultqvist, Bengt, **The spherical harmonic development of the geomagnetic field, epoch 1945, transformed into rectangular geomagnetic coordinate systems.** *Arkiv för Geofysik*, Stockholm, 3(3):53–61, **1959.** fig., 3 tables, 14 refs., 5 eqs. **DLC**—The spherical harmonic development of the earth's magnetic field, for epoch 1945, has been transformed into rectangular coordinate systems with the Z-axis in the direction opposite to that of the earth's dipole and with the X-axis in those 36 geomagnetic meridian planes having a geomagnetic longitude of 0°, 10°, 20° . . . 350° respectively. *Subject Headings:* **1. Geomagnetic field 2. Harmonic analysis.**—*Author's abstract.* Ⓢ

11.10–191 550.382:526.8:681.14:621.38

Hultqvist, Bengt, **The geomagnetic field lines in higher approximation.** *Arkiv för Geofysik*, Stockholm, 3(4):63–77, **1959.** 5 figs., table, 20 refs., 18 eqs. **DLC**—A perturbation calculation, the numerical work of which was made by the Besk, a Swedish electronic digital computer, was carried out taking into account up to the fifth term of the spherical harmonic development. The basis was VESTINE's et. al., analysis of the geomagnetic field for epoch 1945. The tabulated data are discussed in relation to problems of geomagnetism, aurora, atomic rays and meteoric whistlers. *Subject Headings:* **1. Geomagnetic field 2. Electronic computer uses.**—*W.N.* Ⓢ

11.10–192 550.385(431):550.384

Fanselau, G. and Zander, W., **Vorläufiger Bericht über die Beobachtungen am Adolf-Schmidt-Observatorium für Erdmagnetismus in Niemegk in der Zeit vom 1. Januar bis 30. April 1958.** [Preliminary report on observations made at the Adolf-Schmidt Geomagnetic Observatory, Jan. 1–April 30, 1958.] *Beiträge zur Geophysik*, Leipzig, 68(2):104–109, **1959.** fig., tables. **DWB, DLC**—In direct continuation of earlier work (*see* 7.3–33, March 1956, *Met. Abstr.*), the tables presented here give the figures for the geomagnetic activity from 0000 through 2400 G.M.T.; further the Bartels code figures for the eight 3-hr. intervals of each day and finally the code figures K_1 and K_2. Daily means of the components X—north, Y—east and Z—vertical are shown in diagrams. The period covered is Jan., Feb., March, 1958. *Subject Headings:* **1. Magnetic disturbances 2. Niemegk, Germany.**—*W.N.* Ⓢ

11.10–193 550.385:551.594.12:662.2:539.1

McNish, A. G. (*National Bureau of Stands., Wash., D. C.*), **Geomagnetic effects of high-altitude nuclear explosions.** *Journal of Geophysical Research*, Wash., D. C., 64(12):2253–2265, Dec. **1959.** 15 figs., 10 refs. **DLC**—Two high-altitude nuclear explosions near Johnston Island in August 1958 produced distinct geomagnetic effects at Honolulu, Palmyra Island, Fanning Island, Jarvis Island, and Apia. No other operating magnetic observatories reported discernible effects. The effects at the first four observatories are attributed to overhead currents caused by increased ionization of the atmosphere by γ rays and their secondaries from the detonations. The effects at Apia are attributed to charged particles from the detonations and Compton electrons released from the air around the detonation. *Subject Headings:* **1. Geomagnetic disturbances 2. Nuclear explosion effects on geomagnetism.**—*Author's abstract.* Ⓢ

11.10–194 550.385.25

Raja Rao, K. S. (*Met. Office, Poona, India*), **Lunar daily variation of geomagnetic horizontal intensity at Alibag.** *Journal of Geophysical Research*, Wash., D. C., 65(1):119–121, Jan. **1960.** fig., 4 refs., 4 eqs. **DWB, DLC**—Following the mathematical development of CHAPMAN and MILLER, TSCHU has described a practical method of determining the lunar daily variation of geophysical elements. By application of the CHAPMAN-MILLER method as described by TSCHU, the lunar semidiurnal variation of geomagnetic horizontal intensity at Alibag is worked out for the equinoctial season by making use of the hourly values of the element for the period 1940 to 1944. The expression $L(II) = 1.2 \sin(2\tau + 62°) \pm 0.3$, where $L(H)$ is the amplitude of the lunar variation in the horizontal intensity H and τ is the lunar time reckoned from lower transit of mean moon at Alibag is obtained for lunar semidiurnal variation. $L(II)$ is a maximum when the lunar time is 2 lunar hours past midnight or noon. The solar diurnal variation is also determined up to 4 harmonics. A comparison of these results with similar results for Kodaikanal suggests that solar and lunar variations are independent of each other. *Subject Headings:* **1. Lunar diurnal magnetic variations 2. Geomagnetic field intensities.**—*Author's abstract.* Ⓢ

11.10–195 550.385.26

Hasegawa, M. (*Fukui Univ., Japan*), **On the position of the focus of the geomagnetic Sq current system.** *Journal of Geophysical Research*, Wash., D. C., 65(5):1437–1447, May

1960. 14 figs., 8 refs. **DLC** —This paper reviews present knowledge about the S_q foci, discusses the cause of changes in the S_q field, and describes problems concerning the determination of the S_q focus. It is concluded that the foci in the potential fields of geomagnetic D_q variations may be taken as approximately indicating the positions of ionospheric S_q current foci. *Subject Headings:* **1. Magnetic current systems 2. Geomagnetic disturbance centers.**—*Author's abstract.* Ⓢ

11.10–196 550.385.26

Kazmi, S. A. A. (*Geophysical Inst., Quetta, Pakistan*), **On the geomagnetic Sq-variation of horizontal force in middle latitudes.** *Geophysica*, Helsinki, 7(1):31–42, **1959.** 4 figs., 2 tables, 7 refs., eq. **DWB, DLC**—When the quiet-day diurnal variation of horizontal force at observatories near the middle latitudes is represented by the harmonic coefficients of the Fourier series $\Sigma c_n \sin(nt+\alpha_n)$, $n=1, 2, 3$ and 4, the variability of these coefficients with season, latitude and longitude affords a most appropriate material for the study of intensity, distribution and movement of the horizontal current-system producing geomagnetic variation equivalent to the *Sq*-field. The quiet-day *H*-variation at twelve observatories near this region is analysed in the above way for the time of sunspot minimum. It is observed that longitudinal influence on the *Sq*-field is much more pronounced than hitherto expected. The center of the current-vortex of the *Sq*-field is found to lie between $\pm 30°$ and $\pm 35°$ in the Eastern Hemisphere and moves approximately parallel to the magnetic rather than geographic or geomagnetic Equator during its twenty-four hour passage round the earth. The seasonal northward and southward shift of the current-vortex is observed to follow a certain scheme relative to the seasonal latitudinal movement of the sun. This center is believed to reach its extreme southward position in the Northern Hemisphere in September and its extreme northward position in the Southern Hemisphere in March, not at local summer solstice. The activity of the *Sq*-field in the middle latitude on either side of the center of the current-vortex seems to be predominant during the Equinoxes but is not symmetrical in the two seasons (spring and autumn). The spring activity is considerably different from the autumn activity. This is in accord with the above scheme for the seasonal movement of the current-vortex. *Subject Headings:* **1. Seasonal magnetic variations 2. Magnetic current systems 3. Geomagnetic disturbances.**—*Author's abstract.* Ⓢ

11.10–197 551.594.5:550.385.3

Egeland, Alv, **An investigation of the microstructure of the perturbations in the geomagnetic field in the auroral zone.** *Oslo. Universitet. Instituut for Teoretisk Astrofysikk, Report*, No. 6, June **1959.** 19 p. 13 figs., 2 tables, 5 refs. **DWB**—The work presented is an investigation of oscillations in the geomagnetic field occurring in the frequency range 2–7000 c/s. The measurements were made in the auroral zone, in Nov. 1957 and June–July 1958. The spectrum was recorded by three different methods: film, tape and direct frequency recording. The records were analyzed by the statistical methods, and the most important features of the magnetic spectra were found to be broad bands and some spectral "lines." Two different mechanisms for generation of the observed spectra are discussed. *Subject Headings:* **1. Auroral zones 2. Auroral-geomagnetic relationships 3. Geomagnetic field variations.**—*Author's abstract.* Ⓢ

11.10–198 550.385.3:523.164.82

Wood, M. B. and Warwick, C. S. (*both, Nat. Bur. of Standards, Boulder, Colo.*), **Geomagnetic disturbance and velocity of slow-drift solar radio bursts.** *Nature*, London, 184(4697, Supp. No. 19):1471–1472, Nov. 7, **1959.** fig., 6 refs. **DWB**—A possible relation between bursts of solar radio noise and geomagnetic disturbances has been suggested by A. R. Thompson (Paris Symp. on Radio Astronomy). The observed rate of decrease of frequency can be related to a velocity, if some model of coronal density is assumed. Diagrams show relation between frequency drift rate vs. frequency for type II bursts followed by a geomagnetic disturbance and followed by no disturbance, respectively, revealing different slope of curves. *Subject Headings:* **1. Geomagnetic disturbances 2. Solar radio noise bursts 3. Solar-magnetic relationships.**—*A.H.K.* Ⓢ

11.10–199 550.385.37

Benioff, Hugo (*Calif. Inst. of Technology*), **Observations of geomagnetic fluctuations in the period range 0.3 to 120 seconds.** *Journal of Geophysical Research*, Wash., D. C., 65(5):1413–1422, May **1960.** 27 refs., 4 refs. **DLC**—Data are presented from a 5-year series of observations of geomagnetic fluctuations in the period range 0.3 to 120 seconds, approximately. These were carried on with flux rate variographs using pickup coils with 1-second-period galvanometers recording photographically at a trace speed of 1 mm/sec with maximum sensitivities of 0.05 gamma/sec per trace millimeter. Four characteristic types of oscillations are included in this study: type A oscillations, approximately sinusoidal in form, range in period from 0.3 to 2.5 seconds and in southern California occur at night only. They exhibit a negative correlation with sunspot numbers. Type B oscillations are nearly sinusoidal in form with periods ranging from about 3 to 8 seconds. They appear to be associated with the local occurrence of auroras. Type C oscillations are nearly sinusoidal in shape with periods ranging from about 7 to 30 seconds. In southern California they occur in daylight and exhibit a strong correlation with sunspot numbers. Type D oscillations are transients in the form of single or multiple pulses or trains of several oscillations. The pulse breadths or oscillation periods range from about 40 to 120 seconds or more. They are strictly nocturnal in southern California with a sharp peak in the rate of occurrence at local midnight. Some characteristics of sudden-commencement components in the observed period range are mentioned briefly. *Subject Headings:* **1. Geomagnetic fluctuations 2. Solar-magnetic relationships 3. Auroral-magnetic relationships.**—*Author's abstract.* Ⓢ

11.10–200 550.385.37:550.375

Coulomb, J., **Les pulsations du champ magnétique terrestre et des courants telluriques.** [Pulsations of the geomagnetic field and telluric currents.] *Annali di Geofisica*, Rome, 12(4):461–487, Oct./Dec. **1959.** 13 figs., table, 29 refs. French, English and Italian summaries p. 485. **DLC**—Review of observational knowledge on pulsations of magnetic field and telluric currents. *Subject Headings:* **1. Magnetic pulsations 2. Telluric currents.**—*Author's abstract.* Ⓢ

11.10–201 523.164.32:550.385.4

McLean, D. J. (*School of Physics, Univ. Sydney*), **Solar radio emission of spectral type IV and its association with geomagnetic storms.** *Australian Journal of Physics*, Melbourne, 12(4):404–417, Dec. **1959.** 5 figs., 2 tables, 14 refs. **DLC**—A new type of solar radio event, the type IV storm, first described by Boischot, has been identified on Dapto radio-spectrographic records. It has been shown to be distinguishable from type I storms by 1) its smooth spectrum, 2) its close association with type II bursts, and 3) its remarkably close association with geomagnetic storms. In common with some type I storms, all type IV storms are found to be associated with very large solar flares. It appears possible to explain the production of type IV emission and the occurrence of the related phenomena in terms of a single cloud of gas which moves through the Sun's corona. *Subject Headings.* **1. Solar radio emissions 2. Solar-magnetic relationships 3. Geomagnetic storms.**—*Author's abstract.* Ⓢ

11.10–202 551.521.67:550.385.4

†Obayashi, Tatsuzo (*Hiraiso Radio Wave Obs. Radio Res. Labs.*), **Geomagnetic storms and the earth's outer atmosphere.** *Japan. Science Council. Ionosphere Research Committee, Report of Ionosphere Research in Japan*, 12(3):301–335, Sept. **1958.** 21 figs., (incl. photos), table, 42 refs., 36 eqs. **DWB**—Hydromagnetic oscillations of the ionized outer atmosphere excited by solar corpuscular radiation are considered. The observational evidence of world-wide geomagnetic pulsations yields the distribution of ionic density in the outer atmosphere extending beyond the ionosphere. Taking into consideration various results of research concerning the outer ionosphere, such as whistlers, geomagnetic disturbances, cosmic rays and zodiacal light, a consistent model of the Earth's outer atmosphere is proposed. A great geomagnetic storm of Feb. 11, 1958 is discussed as hydromagnetic disturbances in the outer atmosphere. From the analysis of outstanding short-period oscillations of the geomagnetic field, it is shown that during geomagnetic storms a corpuscular cavity is formed surrounding

the earth's magnetic field, and that the size of cavity varies from 2 to 5 earth radii according to the kinetic energy density of incoming corpuscular clouds. This result is in good accordance with actual auroral displays and particular ionospheric disturbances. The behavior of the solar corpuscular magnetic clouds in the interplanetary space is also revealed using the result of the estimation of particle density in the clouds. It is found that these magnetic clouds are considerably slowed down by interplanetary gas. Corpuscular clouds cease to advance and remain a considerable time at distances of about 2∼5 A.U. from the Sun forming the region of interplanetary disordered magnetic field, and the outside of this region is likely to be pervaded by the intergalactic magnetic field. Thus the interplanetary space can be divided into two regions: The inner planetary space is exposed by the solar corpuscular radiations, the constituent of gas must be fully ionized hydrogen viz. the solar HII region and possibly be the extension of the solar corona. The outer planetary space will be the HI region (neutral hydrogen) of low kinetic temperature and the intergalactic magnetic field would prevail. This model of the interplanetary space is also supported by the recent result of cosmic ray disturbances accompanied by intense solar flares. *Subject Headings:* **1. Geomagnetic storms 2. Outer atmosphere 3. Interplanetary space 4. Solar corpuscular radiation.**—*Author's abstract.*

11.10–203 550.385.43

Srinivasamurthy, B. (*Kodaikanal Obs., Kodaikanal*), **The diurnal variation of sizes of sudden commencements and impulses in the Kodaikanal magnetograms.** *Indian Journal of Meteorology and Geophysics*, New Delhi, 11(1):64–68, Jan. **1960.** 4 figs., 7 refs., 4 eqs. **DWB, DLC**—Combined data of sudden commencements (SCs) and sudden impulses (SIs) recorded at Kodaikanal (geomag. lat. 0.6°N) during the period 1949–57 have been analysed in order to study the relationship between the diurnal variation (DV) in the amplitudes of the impulses and the DV in the horizontal component of the earth's magnetic field (the Sq variation in H). There is a statistically significant daytime enhancement in SC sizes similar to the enhancement in Sq variation. Furthermore, this enhancement is larger on days with larger Sq variation than on days with smaller Sq variation. These results confirm those obtained by FORBUSH and VESTINE (1955) at Huancayo, another station near the geomagnetic equator. *Subject Headings:* **1. Sudden commencements 2. Kodaikanal, India.**—*Author's abstract.* Ⓢ

11.10–204 550.385.43

Berthold, W. K.; Harris, A. K. and Hope, H. J. (*all, U. S. Army Signal Res. & Dev. Lab., Fort Monmouth, N. J.*), **Correlated micropulsations at magnetic sudden commencements.** *Journal of Geophysical Research*, Wash., D. C., 65(2):613–618, Feb. **1960.** 6 figs., 17 refs. **DLC**—By the use of very large loops of wire, many square miles in area, nearly simultaneous micropulsations were recorded in Arizona and New Jersey during the initial phase of a magnetic storm. Evaluation of the two records (15 min. recording time) by cross correlation showed a time difference in arrival of common signals of 2 to 3 seconds. A similar difference was observed for the sudden commencement itself. The method used is simple and relatively unaffected by interference. The maximum sensitivity, 1.7×10^{-4} gamma sec^{-1} mm^{-1}, could be used only during magnetically quiet periods. At two other sudden commencements, a remarkable resemblance was found in the fine details at the variations present. The over-all study includes effects from both natural and man-made causes. Another paper will discuss the man-made effects. *Subject Headings:* **1. Sudden commencements 2. Geomagnetic micropulsations.**—*Author's abstract.* Ⓢ

11.10–205 550.385.43

Lawrie, J. A. (*Dept. Scien. & Indus. Res., Magnetic Survey, Botanic Gardens, New Zealand*), **Rapid fluctuations during magnetic disturbance.** *Journal of Atmospheric and Terrestrial Physics*, N. Y., 17(1/2):145–149, Dec. **1959.** 3 figs., 2 tables, 3 refs. **DWB, DLC**—Data for eight magnetic stations ranging from Lovö (58°N geomagnetic latitude) to Apia (16°S) and Hermanus (33°S) are used to calculate coincidence ratios for rapid geomagnetic fluctuations during sudden disturbances such as that of Nov. 9–13, 1956. About 100 marked impulses of 30 sec to 5 min duration were chosen from records at Lovö to serve as basic data. Fluctuations were described by type, duration, time (center of fluctuation) and sign ratios were calculated

or both H and D, and for each 6 hours of a Greenwich day, and all 8 types are shown on graphs rranged according to distance from Lovö. A high positive coincidence ratio is shown for tations up to 500 km (i.e. Kude Skov) and some positive residue even at very great distances. Iowever no coincidence was found at Apia. *Subject Headings:* **1. Geomagnetic fluctuation oincidence ratios 2. Sudden commencements.**—*M.R.* Ⓢ

5. WHISTLERS

11.10–206 551.594.6:551.594.12:550.38

Corcuff, Y., **Choix d'un paramètre caractérisant les sifflements radioélectriques.** [Choice f a parameter characterizing radioelectric whistlers.] *Annales de Géophysique*, Paris, 16(1): 28–139, Jan./March **1960.** 8 figs., 6 tables, 6 refs. French and English summaries. **DLC**—), the dispersion of the whistlers, which is proportional to the path length of the energy, has een taken as their character number. The *D*-dispersion is expressed in the form

$$D = \frac{1}{C}\sqrt{\frac{e}{2}}\int\sqrt{\frac{N}{H}}ds$$

here N=density of ionization along the trajectory, and H=intensity of the terrestrial nagnetic field. The scattering of D depends on the frequency of the waves received. Con- equently, the analysis of the long whistlers leads to consider the dispersion as frequency ependent, and so to specify the frequency for which it is calculated. 4 kc/s and zero fre- uencies seem especially interesting. The methods which may be used to determine the ispersion of any whistler in both cases are described and discussed. *Subject Headings:* **. Whistler analysis 2. Ion density 3. Geomagnetic field intensities.**—*A.V. and author's bstract.* Ⓢ

11.10–207 551.506.22:551.594.6(797)

Dinger, Harold E. (*U. S. Naval Res. Lab., Wash., D. C.*), **A four-year summary of whistler ctivity at Washington, D. C.** *Journal of Geophysical Research*, Wash., D. C., 65(2):571–575, eb. **1960.** 10 figs., 3 tables, 3 refs. **DLC**—Whistler and dawn chorus activity as recorded at Vashington, D. C., during the period of July 1, 1955, to June 30, 1959, has been tabulated nd summarized. Of the 1461 days considered in this analysis, 94 per cent had activity of ome form. The equivalent of approximately five hundred 1800-foot reels of magnetic record- ng tape was analyzed. The last 2 years of the period covered was part of the IGY/IGC osnospheric Physics Program. *Subject Headings:* **1. Whistler data 2. IGY Whistler program . Washington, D. C.**—*Author's abstract.* Ⓢ

11.10–208 551.506.22:551.594.6

†Helliwell, R. A. and Morgan, M. G., **Atmospheric whistlers.** *Institute of Radio Engineers, V. Y., Proceedings*, 47(2):200–208, Feb. **1959.** 10 figs., 31 refs., 6 eqs. **DLC**—A general escription of atmospheric whistlers is given. Their discovery, and the development and roof of a theory to explain them, are reviewed. The IGY synoptic program of study is escribed and examples of results, both individual and statistical, are presented and discussed. *ubject Headings:* **1. Whistlers 2. IGY whistler program.**—*Authors' abstract.* Ⓢ

11.10–209 551.501.83:551.594.6

Hoffman, W. C. (*Hughes Res. Lab., Culver City, Calif.*), **The current-jet hypothesis of histler generation.** *Journal of Geophysical Research*, Wash., D. C., 65(7):2047–2054, July **960.** 2 figs., 26 refs. **DLC.** Condensed version in *Planetary and Space Science*, N. Y., (1):72–73, Oct. **1959.** 5 refs. **DWB**—In the current-jet theory of whistler generation, the enetration of the lower ionosphere is accomplished by a high-energy current jet which is nitted from the top of the thundercloud shortly after the spheric discharge occurs. The resent note briefly outlines this hypothesis and reviews the evidence for it. G. C. Rumi's adar observations are presented as the most significant evidence on the matter. Rumi's bservations can be tested by making simultaneous observations with a whistler receiver and an f radar equipment. It is maintained that time coincidence (with appropriate lags) of

whistler signals and echoes from upward discharges would provide a powerful argument for the current-jet hypothesis. *Subject Headings:* **1. Whistlers 2. Radar observation of whistlers.** —*I.S.* Ⓢ

11.10–210 551.594.6:551.515.1

Mook, Conrad P. (*Diamond Ordnance Fuze Lab., Wash., D. C.*), **A preliminary meteorological study of the origin of whistlers.** *Journal of Geophysical Research*, Wash., D. C., 64(7):745–748, July **1959.** fig., 10 refs. **DLC**—A possible unique source of whistling atmospherics is found to be the presence of large cyclonic disturbances at the geomagnetic conjugate point for the whistler receiving station. The possible role of these cyclonic disturbances in producing narrow magneto-ionic duct propagating conditions is also discussed. *Subject Headings:* **1. Origin of whistlers 2. Whistlers.**—*Author's abstract.* Ⓢ

11.10–211 551.594.6:551.501.81

Morgan, M. G.; Curtis, H. W. and Johnson, W. C. (*Thayer School of Engineering, Dartmouth Coll. Hanover, N. H.*), **Path combinations in whistler echoes.** *Institute of Radio Engineers, N. Y., Proceedings*, 47(2):328–329, Feb. **1959.** 2 figs., 2 tables, 3 refs. **DLC**—The report is presented in the wake of STOREY's confirmed deduction that "whistlers echo back and forth between the hemispheres." It is also an investigation that applies the concept of path combinations in echoes to one of the spectrograms published by MORGAN and ALLCOCK in the January 7, 1956 issue of *Nature*, vol. 177, p. 30–31. The spectrogram discussed is one recorded on November 11, 1956 at Unalaska (50° geomag. lat.) in the Aleutian Islands. It shows dispersion curves that are 60 in the lower and 120 in the higher noise-frequency. Hence, it is observed that the echo of a short whistler has thrice the dispersion of the initial one. The conclusion is reached that a second path that has twice the dispersion of the normal path must be present. *Subject Headings:* **1. Whistler paths 2. Unalaska, Aleutian Islands.**—*N.N.* Ⓢ

11.10–212 551.594.6

Morgan, M. G. (*Dartmouth College*), **Whistlers.** *Journal of Atmospheric and Terrestrial Physics*, London, 15(1/2):54–57, Sept. **1959.** fig., 17 refs. **DLC**—The theory of whistlers originated during World War I by BURKHAUSEN and completed by STOREY in 1951, is examined in the light of various observations. The distinction between tweeks and whistlers, as recognized by BURTON in 1930 and by ECKERSLEY in 1935, is recalled. STOREY, ALLCOCK, MORGAN, HELLIWELL and GEHRELS developed the theory of the path of whistler with conjugate positions in the Northern and Southern Hemispheres. A number of discoveries corroborating basic facts of whistlers are evaluated. The evidence that whistlers are ideally suited for synoptic research, and the study of magnetic tape recordings for the widening knowledge of the ionosphere and the earth's field are emphasized. *Subject Heading:* **1. Whistlers.**—*O.T.* Ⓢ

11.10–213 546.11:551.510.536:551.594.6

Outsu, Jinsuke and Iwai, Akira, **Investigation of the presence of ionized hydrogen in the outer atmosphere using whistler dispersions.** *Nagoya. Univ. Research Institute of Atmospherics, Proceedings*, 6:44–55, Jan. **1959.** 7 figs., 7 refs., 4 eqs. **DWB**—A trial is made to detect the presence of ionized hydrogen in the outer atmosphere following a theory concerning the corrections of the dispersion law of whistlers given by STOREY, which involves effects of light ions as well as electrons on dispersion. Four short whistlers most suitable for this purpose are analyzed, which were observed at Toyokawa and Wakkanai stations all on different dates. These were pure and fairly well defined down to frequencies lower than 1000 c/sec and one of them was preceded by tweek type atmospheric click, which made it easier to time. The electron density used by STOREY is too small to produce the dispersions observed, so different distributions of electron density are assumed so as to satisfy the dispersions observed. From these distributions two complete dispersion curves are calculated each for the case of Toyokawa and Wakkanai. The dispersions measured from whistler traces agreed fairly well with the theoretical curves. From this result the presence of ionized hydrogen in the outer atmosphere is strongly supported. But is seems to be necessary to investigate the shape of the ray path as exactly as possible in order to solve the problem of distribution of ionization density and

obtain further information on the constituent of the ionization. *Subject Headings:* **1. Ionized hydrogen in outer atmosphere 2. Whistler dispersions.**—*Authors' abstract.* Ⓢ

11.10–214 551.594.6

Ungstrup, Eigil (*Royal Tech. Univ. of Denmark*), **Observations of 'whistlers' and very low frequency phenomena at Godhavn, Greenland.** *Nature*, London, 184(4689), Supp. No. 11:806–807, Sept. 12, **1959.** fig., 6 refs. **DWB**—The reported recordings of whistlers were made at Godhavn, Greenland from July 19, 1957, to the end of July 1958. The total number of whistlers observed during one year is nearly 125, of which about 50 have been analyzed. The results of these analyses are discussed and the distribution of minimum frequencies of whistlers is graphically represented. *Subject Headings:* **1. Whistlers 2. Godhavn, Greenland.**—*I.S.* Ⓢ

6. EXOSPHERE—VAN ALLEN BELT—ZODIACAL LIGHT

See also: **Cosmic electrodynamics** (Dungey), 11.10-3; **Artificial Earth Satellites** (Akad. Nauk SSSR), 11.10–11; **Atmospheric re-entry** (Nonweiler), 11.10–32; **Satellite orbits and air resistance** (El'iasberg), 11.10–37; **Range traveled in atmosphere by entry vehicle** (Cheatham et al.), 11.10–42; **Terrestrial particles from solar flares** (Ward), 11.10–79; **Geomag. storms and earth's outer atmosphere** (Obayashi), 11.10–202; **Ionized hydrogen in outer atmosphere and whistler dispersion** (Outsu, Iwai), 11.10–213.

11.10–215 551.521.64:550.385.4

Akasofu, Syun-Ichi (*Geophysical Inst., Univ. Alaska*), **The ring current and the outer atmosphere.** *Journal of Geophysical Research*, Wash., D. C., 65(2):535–543, Feb. **1960.** 3 figs., table, 37 refs., 32 eqs. **DLC**—It is shown that hydromagnetic propagation will enable the earth's field at ground level to be affected with a lag of less than 1 minute by changes in electric currents far above the earth; for example, by a changing ring current with a radius a few times that of the earth. It is shown that a system of trapped high speed charged particles, such as those in the Van Allen belts, involves electric current flow; the deciding factor is the curvature of the guiding lines of the geomagnetic field. Thus an enhancement of the Van Allen radiation belts will decrease the horizontal geomagnetic component. Such a change is observed during the main phase of a magnetic storm. A suggestion is made about the origin of trapped high-energy particles from the analysis of two large magnetic storms during the IGY. *Subject Headings:* **1. Ring currents 2. Outer atmosphere 3. Van Allen belts.**—*Author's abstract.* Ⓢ

11.10–216 551.510.536:551.521.64:550.385.4

Obayashi, Tatsuzo (*Radio Res. Lab. Kokubunji, Tokyo*), **Physical state of outer atmosphere and the origin of radiation belts.** *Journal of Geomagnetism and Geoelectricity*, Kyoto, 11(3):80–84, **1960.** 2 figs., 11 refs., 4 eqs. **DWB**—A possible mechanism trapping high energy particles in the radiation belts surrounding the earth is proposed, taking into account the existing hydromagnetic waves in the outer atmosphere. It is shown that there are two regions where the amplitude of hydromagnetic waves and the compressibility of gas bearing magnetic field are large. Since the acceleration mechanism is operative in such regions, particles inside the regions may be raised in their energies, and consequently they produce local inhomogeneities of hot plasmas. These hot plasmas interact with the geomagnetic field and may form a certain kind of magnetic bottles, in which the high energy particles are likely trapped. The inner activated region is expected at the height 1000∼3000 km and the outer region is of the order of 20,000 km. Although the origin of high energy particles is possibly of injected solar particles, their concentration at particular regions may be controlled considerably by the hydromagnetic nature in the outer atmosphere. *Subject Headings:* **1. Outer atmosphere 2. Van Allen belts.**—*Author's abstract.* Ⓢ

11.10–217 551.507.321:551.594.5:537.531

Anderson, Kinsey A. (*Royal Inst. of Technology, Stockholm, Sweden*), **Balloon observations of X-rays in the auroral zone, Pt. 1.** *Journal of Geophysical Research*, Wash., D. C., 65(2):551–564, Feb. **1960.** 13 figs., table, 12 refs. **DLC**—During high-altitude balloon flights made in

the northern auroral zone, fluxes of X rays have frequently been observed. By means of sodium iodide scintillation crystals and pulse height analyzers also carried in the balloon instrumentation detailed measurements of the photon energy spectrum in the region 40 to 340 kev have been obtained. These X rays generally appear without definite geophysical or solar correlation. They are believed to be directly related to the soft radiation investigated by rockoons and also to processes occurring in the outer Van Allen radiation zone. The rapid intensity and spectral fluctuations that are observed suggest that in addition some process, possibly atmospheric discharge, may also be important. The relation of these X rays to visible auroras is not clearly established here. *Subject Headings:* **1. Auroral zones 2. High-altitude balloon ascents 3. X-radiation 4. Van Allen belts.**—*Author's abstract.* Ⓢ

11.10–218 551.594.12:550.388

Ray, Ernest C. (*State Univ. of Iowa*), **On the theory of protons trapped in the earth's magnetic field.** *Journal of Geophysical Research*, Wash., D. C., 65(4):1125–1134, April **1960.** 2 figs., 23 refs., 42 eqs. **DLC**—A differential equation of transport is written for protons losing energy in an atmosphere but not scattering. It is solved under the approximation that a proton loses a negligible amount of energy while it drifts once around the earth in longitude. Three cases are treated: the equilibrium solution with input and loss rates equal; the solution for impulsive injection at $t=0$, the intensity then dying away; and the solution for the intensity zero initially, the input mechanism being turned on at $t=0$. No numerical work bearing on the geometry of the source function is included. The treatment is an improvement over previous ones in that it adequately treats the particles as moving along their actual trajectories. A detailed comparison with observations over South Africa shows that the altitude dependence of intensity is roughly consistent with the view that the particles seen by the unshielded Geiger tube on 1958ε are protons supplied by a weak source (for example by decay of albedo neutrons) which are lost to the detector when their energy is reduced below the detection threshold by absorption. The atmosphere required has a temperature of about 2000°K at 400 km if it is pure dissociated nitrogen. At some height between 1100 and 1300 km the scale height sharply increases in a way consistent with the view that at this height the composition changes to pure dissociated hydrogen. Only relative intensities are used in these comparisons. *Subject Headings:* **1. Trapped protons 2. Van Allen belts 3. Magnetic effects on cosmic rays.**—*Author's abstract.* Ⓢ

11.10–219 551.594.5:550.388.8

Rees, M. H. and Reid, G. C. (*Alaska Univ.*), **The aurora, the radiation belt and the solar wind: a unifying hypothesis.** *Nature*, London, 184(4685), Supp. No. 8:539–540, Aug. 15, **1959.** 3 figs. **DWB**—The present communication briefly reports recent high time resolution spectroscopic studies of aurora at College, Alaska, and presents a semi-quantitative explanation of the latitude drift of the hydrogen emission by examining the effect of incoming solar particle streams on the trapped Van Allen radiation. Variation of the geomagnetic co-latitude with time for a six-day period is graphically presented. Graphical presentations of the distortion of the geomagnetic field on the day-side of the earth due to an approaching solar particle stream and of the extent of latitude drift are also included. *Subject Headings:* **1. Aurora 2. Van Allen belts 3. College, Alaska.**—*I.S.* Ⓢ

11.10–220 551.510.536:551.594.12:550.388

†Tamao, Tsutomu (*Geophys. Inst., Tohoku Univ.*), **Some problems on the cosmical hydromagnetics and their application to the phenomena of the outer atmosphere.** *Tohoku University, Science Reports, 5th Ser., Geophysics*, 10(3):81–118, March **1959.** 7 figs., 4 tables, 50 refs., eqs. **DWB, DLC**—Using the Boltzmann transport equation the fundamental hydromagnetic equations for the fully ionized electron-proton gas are derived including the generalized Ohm's law in terms of magnetic field intensity, mean velocity, current density and pressure stress tensor of the mixture. Appropriate boundary conditions of continuity of the physical quantities for cosmic conditions are presented. Some mechanical equilibrium configurations for the rotation of conducting gas in a magnetic field are discussed for the case of axial symmetry. The effects of field, radiation, viscosity and of internal circulation on the rotation of

an ionized gas are interpreted in terms of the transport of angular momentum and the flow tensor of the transport of angular momentum is introduced. Decay of a rotational motion of a conducting rigid sphere immersed in an infinitely extending conducting fluid with uniform magnetic field is studied and it is shown that the rotational motion caused by an impulsive couple breaks down in relatively short time in the process wherein the original angular momenta are transported into the surrounding gas by the induced hydromagnetic wave. The rotational instability of an infinitely long cylinder with axial magnetic field is investigated. It is shown that the presence of a field inhibits the rotational instability, and the instability occurs if the kinetic energy of rotation becomes of the order of that of the magnetic field. The physical conditions of the earth's exosphere are reviewed. It is suggested that the problem of an interaction between the exosphere and the interplanetary gas may be treated as that of plasma electrodynamics in a thin boundary layer with the thickness of the order of the electron plasma wavelength between above two regions, and the physical character of this layer is discussed. A model of the hydromagnetic torsional oscillations which may be caused by sudden increase of solar radiation is studied quantitatively. *Subject Headings:* **1. Outer atmosphere 2. Magneto-hydrodynamics.**—*Author's abstract.* Ⓢ

11.10–221 551.510.536:551.594.12:551.594.6

Gallet, Roger M., **The very low-frequency emissions generated in the earth's exosphere.** *Institute of Radio Engineers, N. Y., Proceedings*, 47(2):211–231, Feb. **1959.** 15 figs., 2 tables, 13 refs., 14 eqs. **DLC**—Naturally occurring, very low-frequency signals not associated with lightning discharges, and strongly correlated with solar activity, have been recognized nearly as long as the atmospheric whistlers which have their genesis in lightning discharges. Whereas whistlers have been satisfactorily explained, until recently these other phenomena have not. From the examination of a large quantity of high resolution spectrograms, it has been deduced that a major fraction, if not all, of the other "noises" are excited in the exosphere by streams and bunches of high-speed ionized particles precipitating into the ionized atmosphere in the presence of the earth's magnetic field. The electromagnetic waves excited are then propagated in the manner of whistlers. The excitation mechanism is similar to the operation of a travelling-wave tube. Two frequencies are simultaneously generated, and are given by:

$$\omega = \frac{\omega H}{2}\left[1 \pm \left\{1 \pm \left(\frac{\omega p}{\omega H}\frac{V}{c}\right)^2\right\}^{\frac{1}{2}}\right].$$

Their values depend only on the three parameters: local electronic density in the exosphere, local magnetic field intensity, and particle velocity V. For a large range of conditions, corresponding to middle latitude observations, the low frequency explains many types of noise, and reduces to

$$\omega_1 = \left(\frac{V}{c}\right)^2 \frac{\omega p^2}{\omega H}.$$

Most of the observations require particle velocities of the order of 10,000 km/sec. The shape of the spectrum is also very sensitive to the ambient electronic density distribution. A model in which the ratio of electron density to magnetic field strength is almost constant, along a line force in most of the exosphere, seems indicated by several types of noise. Such a model satisfies also the whistler data. The problem of the production of bunches and streams or particles is briefly discussed. *Subject Headings:* **1. Exospheric emissions 2. Whistlers 3. Radio emissions from exosphere.**—*Author's abstract.* Ⓢ

11.10–222 523.59:551.593.9

Pevtsov, G. A., **K istorii otkrytiia zodiakal'nogo sveta.** [On the history of the discovery of zodiacal light.] *Priroda*, Moscow, No. 8:113–114, Aug. **1959.** **DLC**—A brief article showing that the phenomenon of zodiacal light was already known in ancient time, in the second milennium before our era. Examples from ancient literature are cited. The first scientific observations of the phenomenon were made in 1809 by Cassini. *Subject Heading:* **1. Zodiacal light.**—*A.M.P.* Ⓢ

11.10–223 523.59:551.593.9

Blackwell, D. E., **The zodiacal light and its interpretation.** *Endeavour*, London, 19(73): 14–19, Jan. **1960.** 8 figs., 12 refs. **DLC**—An extensively illustrated discussion of the zodiacal light and the theories of its origin. The modern hypothesis of an interplanetary gas and the evidence supporting its existence are examined. The author also mentions his recent attempt during an expedition to the Andes, to detect the supposed interplanetary electrons by an independent method. A vivid photograph of the zodiacal light taken from Chacaltaya at 17,000 ft is included. Data are presented in graphic forms. *Subject Headings:* **1. Zodiacal light 2. Chacaltaya, Bolivia.**—*I.S.* Ⓢ

METEOROLOGICAL OBSERVATIONS AND INSTRUMENTS

METHODS OF OBSERVATION

See also: **Tables of radiation from atmosphere** (Coulson et al.), 11.10–2; **Engl. observations of Russian satellites** (Naturw. Rundschau), 11.10–41; **Literature on radio studies of meteors** (Vincent, Smith), 11.10–110; **Observation of meteor echoes** (Hagfors. Landmark), 11.10–113; **Radio observation of Geminid meteor stream** (Weiss), 11.10–114; **Narrow-beam radio equipment for meteor observation** (Weiss), 11.10–115; **Observation of echoing points in meteor trails** (Weiss), 11.10–116; **Printing register for cosmic ray data** (Ford), 11.10–132; **Photography of cosmic rays in luminescent chamber** (Perl, Jones), 11.10–135; **Color photography of auroras** (Sandford, Heiser), 11.10–184; **Measurements of black-body radiation temperature** (Aagard), 11.10–238; **Vapor pressure measurement at high temperatures** (Farkel), 11.10–240; **Method of studying meteoric dust** (Villermaux), 11.10–244; **Study of low level wind field** (Fisher), 11.10–332; **Vertical atmospheric motions computed from horiz. wind** (Rex), 11.10–346; **Rel. humidity and dew-point** (Sellers), 11.10–351; **Theoretical treatment of dry and wet periods** (Steinhäusser), 11.10–364.

11.10–224 551.501.3:551.521.12

Dogniaux, R., (*R. Met. Institute of Belgium*), **Comparaisons d'échelles pyrhéliométriques.** [Comparisons of pyrheliometric scales.] (In: International Radiation Conference, Davos, Sept. 1956, **Papers. 1956.** (No. 4.) 5 p. Mimeo.) **DWB** (M21.1 161pa)—The standard actinometer and pyrheliometer scale used at Uccle was compared with that of Davos and of the Smithsonian Institution. Results of the comparisons are reported and adoption of the new proposed international scale by the Belgian radiation service is announced. *Subject Headings:* **1. Pyrheliometric scales 2. Radiation measurement comparisons.**—*G.T.*

11.10–225 551.501.45

Nakada, Y. (*Niigata Local Meteor. Observ.*), **A method of analyzing periodic or cyclic variations and some examples.** *Geophysical Magazine*, Tokyo, 29(4):513–526, March **1960.** 4 figs., 4 tables, 6 refs., 7 eqs. **DWB, DLC**—In his previous paper in Japanese the author had shown that any variation may be decomposed into short-period and long-period variations. Suppose that the values of variation at equal time interval are $\varphi_1, \varphi_2, \ldots \varphi_n$, then it can be shown that the short period term is denoted by $S_n=(2\varphi n-\varphi_{n-1}-\varphi_{n-1})/4$, and the long period term by $L_n=(2pn+\varphi_{n-1}+\varphi_{n-1})/4$ and $\varphi_n=L_n+S_n$. As the method seems to be effective for analyzing such cyclic variations as repeated three times or more and be available in studying many natural phenomena, it is reproduced here with some additional illustrations. *Subject Heading:* **1. Variation analysis.**—*Author's abstract.*

11.10–226 551.501.5:551.508.21:551.521

†Gergen, John L., (*G. T. Schjeldahl Co., Northfield, Minn.*), **Black-ball observations and the radiation chart.** *Journal of Meteorology*, Boston, 15(4):350–368, Aug. **1958.** 13 figs., 3 tables, 40 refs., 9 eqs. **DWB, DLC**—This paper presents comparisons of experimentally determined radiation temperatures using the black ball, with such temperatures calculated using the Elsasser radiation chart. The comparisons show that, in general, the calculated temperatures are always warmer than those observed, indicating that the earth and its atmosphere radiate less energy away to space than would be calculated. The agreement between observation and

calculation appears to be best in summer, when the water vapor path length is greater at all altitudes, and worst in winter. A description of the approximations which enter into the calculations and a detailed investigation of the validity of these assumptions, obtained by noting experimental results, are also presented. The conclusions are that some of the approximations are experimentally verified only in part and that two of them, the separation of CO_2, ozone, and water vapor radiative effects, and the use of a pressure scaling factor on path lengths, are clearly invalidated. *Subject Headings:* **1. Radiation measurement techniques 2. Radiation charts 3. "Black Ball" 4. Radiational temperature.**—*Author's abstract.*

11.10–227 551.501.7:551.507.321.2

Sinha, K. L. (*Gauhati Airport, India*), **A method of determining the constant in the balloon-ascent formula.** *Royal Meteorological Society, Quarterly Journal,* 85(365):291–293, July **1959.** fig., table, 10 refs., 5 eqs. **DWB, DLC**—Expressing the coefficient q, of the rate-of-ascent formula of balloons ($V=qF^{\frac{1}{2}}/(WF)^{\frac{1}{3}}$, where V is the rate of ascent of the balloon, W the weight of the balloon and F the free-lift) in terms of the coefficient of aerodynamic resistance k of the balloon, a curve of q as a function of the Reynolds number N is worked out. Introducing a kN^2-N curve, the value of q, appropriate to a balloon flight is obtained. *Subject Heading:* **1. Balloon ascension rates.**—*Author's abstract.*

11.10–228 551.501.721:551.521.31:551.593.55

*Hulburt, Edward Olson, **Measurements and estimates of sky brightness for all altitudes of the sun for various altitudes of the observer above the surface of the earth.** *U. S. Naval Research Laboratory, NRL Report 4870,* Feb. 8, **1957.** 13 p. 10 tables, 9 refs., 4 eqs. Reprint of a paper prepared Dec. 1951. **DWB**—Tables are presented, and theory and use of tables treated in text, for day and twilight sky brightness at 10,000 ft for various altitudes of the sun, positive and negative, 5°, 10° . . . , 90° and altitudes of the point in the sky under observation, 0°, 15°, 30° . . . 90°, plus corrections for regions within 40° of the sun for 10,000, 20,000, 30,000, 40,000 and 50,000 ft. Twilight sky brightness tables are given for Sacramento Peak, N. M. (9210 ft) and for Maryland (100 ft above sea level). Text also treats of night sky brightness with tabular data for 2, 5, 10, 15, 20, 30 . . . 90° on clear nights. *Subject Headings:* **1. Sky brightness measurements 2. Twilight sky brightness 3. Night sky brightness 4. Sacramento Peak, N. Mex. 5. Maryland.**—*M.R.*

OBSERVATIONAL DATA

See also: **Coordination of IGY observations** (Shapley), 11.10–18; **Linz weather observations of J. Kepler** (Grammer), 11.10–22; **Four-year summary of whistler activity at Washington, D. C.** (Dinger), 11.10–207; **Monthly charts of evaporation, N. Indian Ocean** (Privett), 11.10–352.

11.10–229 551.506.3:551.521.11(436)

*Steinhauser, F., **Sonnenschein.** [Sunshine.] (In: Steinhauser, F. et al., (eds.), **Klimatographie von Österreich** (issued as *Akademie der Wissenschaften, Vienna, Denkschriften,* Vol. 3), **1958.** p. 103–136. 5 figs., 4 maps (colored), 9 tables, 27 refs.) **DWB, DLC**—The seasonal and annual sunshine conditions over the periods 1901–1950 and 1928–1950 are discussed in terms of relative duration in order to render the truest possible picture of the regional and local differences from the astronomical possible duration of sunshine in Austria as observed at 62 recording stations. Distribution of insolation is treated first, next the annual variation of sunshine, then follows the dependence of sunshine on height. The other aspects considered are: frequency of daily hrs of sunshine and the daily variation. The discussion is supported by excellent maps, graphs and tables furnishing very detailed data throughout. *Subject Headings:* **1. Sunshine duration 2. Sunshine variations 3. Sunshine data 4. Austria.** —*W.N.*

11.10–230 551.506.22:551.509.317

U. S. Weather Bureau, **Ten-millibar synoptic weather maps, three times monthly, July 1957 through June 1958 of the IGY period.** Wash., D. C., Dec. **1959.** 1 p. text. 36 charts.

14″×16″. **DWB** (M09.22/7 U587te)—The atlas contains 36 analyzed synoptic charts of 1200 GMT 10 mb or 31 km (102,000 ft) temperatures, heights, winds and pressures for the 5, 15 and 25th of each month from July 1957–June 1958 for North America and the adjacent oceans. Data were obtained from WMO, IGY microcards (form 3), USWB Daily N. H. Synoptic Weather Maps, WBAN Form 33 from NWRC at Asheville, and Special U. S. Signal Corps observations. Extrapolation was used in case insufficient data were available at the 10 mb level. Methods of extrapolation and analysis were devised by S. TEWELES, F. G. FINGER, L. ROTHENBERG and R. B. MASON. Contours are drawn for each 40 m level (80 m in winter) and all available data are plotted on the appropriate place on the map with respect to the station. *Subject Headings:* **1. 10 mb synoptic charts 2. IGY upper air data 3. North America.**—*M.R.* ⑤

11.10–231 551.506.3:551.582.2(829) 551.326.7

Maling, D. H., **Some geographical results of the work of the Falkland Islands Dependencies Survey, 1944–1955.** *Advancement of Science*, London, 13(53):460–466, June **1957.** 3 figs., 8 refs. **DLC**—The report covers the activities of 9 bases on the Falkland Islands (only one, Hope Bay is situated on Graham Land) in the fields of routine observation of meteorological and sea-ice conditions, and general topographical surveys made on 3 sledge journeys through unexplored regions of Graham Land. The importance of continuous meteorological observations carried out for a period of 13 years (Deception Island) and 9 years (at three other bases), and of the sea-ice surveys are particularly stressed. The entire work of the survey, divided according to the size of duration of each base, and further subdivided according to the representations of different scientists, is presented in graphs. *Subject Headings:* **1. Meteorological observations 2. Climate of Falkland Islands 3. Ice surveys 4. Falkland Islands.** —*A.M.P.*

INSTRUMENT CARRIERS

See also: **Sec. B2,** p. 1577 (for Rockets and Satellites); **Determining constant in balloon-ascent formula** (Sinha), **11.10–227.**

11.10–232 551.507.321.2:551.521.18

Strong, John, **Balloon observations of earth radiations in the infrared.** Johns Hopkins Univ. Lab. of Astrophysics and Physical Met., Contract AF 19(604)-949, Final Report, Oct. 1, **1957.** 10 p. 8 figs., 2 refs., eqs.—A report by NEWMAN contains a history of the transference of effort from the heavy balloon objective, under which the so-called Palomar spectrometer was built, to the light expendable objective, which the NEWMAN report covers. The present report contains the history of reversion to the heavy balloon objective (with 200-pound gondola). The present report describes the balloon flight of October 4, 1956 which yielded two spectra of the earth from $\lambda=7$ to $\lambda=20\mu$, taken "looking" down from a gondola at 93,000 ft altitude. The disentanglement of first and second order spectra is reported, and the possibilities of such measurement (now being exploited under a subsequent contract) are described. The measurements so far obtained are preliminary but they demonstrate that original objectives can be more than realized and that we have great hope of measuring the divergence of radiation flux up to heights greater than 90,000 ft. Dr. ROBERT GREENLER spent some time developing filters suitable for this program. This work culminated in a publication of which a reprint is attached. *Subject Headings:* **1. Balloon radiation observations 2. Infrared spectra.**—*Author's abstract.*

11.10–233 551.556:551.507.362.1

Hewson, E. Wendell and Woodbury, Max A., **Research study pertaining to low-level wind structure, May 1, 1955 to Nov. 30, 1956.** Michigan. Univ. Engineering Research Institute, Contract DA-36-039, SC-64676, Final Report, July **1957.** 36 p. 4 figs., table, 23 refs., 18 eqs.—A system of equations is developed to calculate the atmospheric effect on a rocket along its flight trajectory. It is found that the major effect is contributed by low-frequency turbulence components. The rocket-influence function is defined which acts as a filter on the turbulent eddies operating along the rocket trajectory. The magnitudes of many terms in the

rocket equations are estimated. It is found that the total of turbulent effects is almost constant for any trajectory, whereas the mean wind effect is a definite function of a given rocket trajectory. Through a Fourier transform of the influence function, a correlation function is determined that would be observed by an object moving along a mean wind path. The binormal dispersion of the rocket is calculated by transforming frequency spectra into space spectra according to Taylor's hypothesis. A prediction scheme is developed to reduce dispersion whereby the rocket launcher will be adjusted to the effects of low-level winds. The scheme is adjudged inferior to a least-squares technique which, however, is much more difficult to evaluate. The mean wind is less applicable to the actual mechanics of a rocket firing system than is the whole wind. The quality of prediction schemes may be improved by the use of Taylor's hypothesis at levels below 150 ft. The combination of a least-squares prediction technique with Taylor's hypothesis for heights of interest holds promise of development in future work. The hypothesis could be tested below 1050 ft by analysis of data obtained from instrumentation on and between two television towers within a mile of each other. The structure of low-tropospheric winds is considered from momentum-transfer theories and by analysis of the surface layers and turbulence regimes. The atmospheric parameters that affect the dispersion of the rocket trajectory after launching are reviewed. Detailed investigations of anemometry, data-reduction systems, and wind-tunnel studies appropriate to this research were deferred in the interest of developing the statistical design. *Subject Headings:* **1. Wind effects on rockets 2. Turbulence effects on rockets 3. Rocket trajectories.**—*Author's abstract.*

INSTRUMENTS

See also: **Instruments for small pressure differences in gases** (Belik), 11.10–4; **Meteorological and aerological instruments** (Novikov), 11.10–10; **Total absorption spectrometer for cosmic ray measurement** (Standil, Loveridge), 11.10–139; **Black-ball observations** (Gergen), 11.10–226; **Continuous automatic recording of ice nuclei** (Bigg, Meade), 11.10–357.

11.10–234 551.508.2:551.521.18:535.245

Louisnard, Nicole and Girard, André, **Mesures effectuées sur quelques cellules photorésistantes dans l'infrarouge.** [Measurements made on some photoresistant cells in the infrared.] *Revue d'Optique*, Paris, 38(12):556–562, Dec. **1959.** 8 figs., 2 tables. French and English summaries p. 556. **DLC**—Infrared measurements over the range 1–6μ are carried out with photocells made of lead sulphide, telluride and selenide. A double rock-salt prism monochromator is used for measuring the spectral sensitivity. The apparatus ensures a suitable frequency response up to 30,000 Hz. The minimum detectable energy is determined for a monochromatic flux at the maximum spectral sensitivity of each photocell. Numerical data of experimental results are tabulated. *Subject Headings:* **1. Infrared radiation detectors 2. Photoelectric cells 3. Infrared radiation measurements.**—*Authors' abstract.* Ⓢ

11.10–235 551.508.25

Schieldrup Paulsen, H. (*Bergen*), **Über die Anwendung von künstlichen Belüftungseinrichtungen bei Strahlungsmessgeräten.** [Use of artificial ventilation equipment in radiation measuring instruments.] *Annalen der Meteorologie*, Hamburg, 8(11/12):337–339, **1959.** 6 figs. **DWB, DLC**—The author used artificial ventilation equipment for the Schulze radiation balance meter but replaced the metal box by a plastic tube. On clear nights no dew or rime formed on the cupola, also during winter the cupola was kept free from snow. The use of ventilators eliminates the melt point depression at least for winter recordings. A high sensitivity (approximately 0.0022 or 0.0048 cal/cm^2 min amplitude in the case of solar radiation or global radiation) is achieved. The recorded night trace fluctuated without ventilation during varying cloudiness, and on clear nights can give up to a negative amplitude of 3 mm. When the ventilator is in operation the outer glass hemisphere is warmed to the air temperature and the freezing point depression is vanishingly small. Graphs showing recordings with the use of the ventilator and without it are presented. *Subject Heading:* **1. Radiation balance meters.** —*I.L.D.* Ⓢ

11.10–236 551.508.21

Ångström, Anders Knutson and Drummond, A. J. (*both, Eppley Lab., Newport, Rhode Island*), **On the influence of thickness and temperature on the "cut-off" characteristics of glass filters.** *Royal Meteorological Society, Quarterly Journal*, 85(366):429–431, Oct. **1959.** fig., 2 tables, 3 refs., 5 eqs. **DWB, DLC**—Schott glass filters OG1, RG2 and RG8 are investigated with respect to the dependence of the lower sharp wavelength 'cut-off' on filter thickness and temperature. Typical values of the main cut-off characteristics are presented conveniently in tabular form. *Subject Heading:* **1. Glass filters.**—*Authors' abstract.* Ⓢ

11.10–237 551.508.21

Ross, Iu., **O vliianii okolosolnechnoĭ radiatsii na rezul'taty graduirovki termoelektricheskikh aktinometrov.** [The influence of circumsolar radiation on the calibration of thermoelectric actinometers.] *Eesti NSV Teaduste Akadeemia. Füüsika ja Astronoomia Instituut, Uurimusi Atmosfäärifüüsikast*, No. 1:43–52, **1959.** 2 figs., table, 2 refs., eqs. English summary p. 52—The amount of radiation from the solar aureole that falls on the receiving surfaces of an Ångström pyrheliometer and a Ianishevsky thermoelectric actinometer differs owing to a difference in the apertures of the instruments. Calculations show that fluctuations in aureole radiation do not have any influence (within the experimental errors) upon the constant of actinometers as determined by means of an Ångström pyrheliometer. Calculations were carried out for two cases: (a) the radiation in a point under observation of the aureole does not depend upon the distance between that point and the center of the sun, (b) the radiation in a point observed of the aureole decreases exponentially with the distance between that point and the center of the sun. The results obtained have been corroborated by measurements carried out in Tartu. *Subject Headings:* **1. Thermoelectric actinometers 2. Ångström pyrheliometer 2. Solar radiation measurement techniques.**—*Author's abstract.* Ⓢ

11.10–238 551.501.721:551.508.22

Aagard, Roger L., **Measurements, by two methods of the equivalent black-body radiation temperature in the atmosphere.** *Journal of Meteorology*, Boston, 16(3):340–343, June **1959.** 4 figs., 3 refs., 1 eq. **DWB, DLC** –Since the black ball is a simple device and can be used with conventional meteorological sounding equipment, but the measurements obtained require a large convection correction whose accuracy is difficult to establish, the author has attempted to compare simultaneous measurements with the black ball and infrared red radiometer, which is independent of convection. The experimental apparatus and procedure are described and atmospheric radiation temperature soundings with the black ball and radiometer made during summer and winter are presented. The results indicate that "the radiometer measurements, in spite of the inaccessible region of positive radiation excess, bear out the general picture of the atmospheric radiation obtained with the black ball for both summer and winter conditions. The measurements with the two instruments agree remarkably well where the radiation temperature excess is less than 15°C. It is thought that the black ball measurements might be improved somewhat with an increase in convection." *Subject Headings:* **1. "Black Ball" 2. Blackbody radiation 3. Radiational temperature.**—*I.L.D.*

11.10–239 551.508.25:535.417:551.521.18

†Smiley, Vern N., **Multilayer interference filters for the infrared.** Colorado. Univ. Upper Air Lab., Contract AF 19(604)-1899, Scientific Report, No. 3, Oct. **1959.** 149 p. 77 figs., 3 tables, 26 refs., numerous eqs. **DWB** (M(051) C719s) —The basic theory of interference filters is discussed starting with the simple Fabry-Perot filter. Methods of calculating the transmittance and reflectance of a multilayer stack are discussed with emphasis on an analog computer method. A derivation of a nearly exact expression of the bandwidth and an expression for the fraction of power transmitted between half-maximum points for an all-dielectric Fabry-Perot filter are given. Band-pass filters of a type containing more than one multiple half-wave layer are examined in detail by calculated curves for several different configurations; they are shown to be superior to the Fabry-Perot dielectric filters. A five-layer dielectric Fabry-Perot filter designed for use as a low-pass filter is treated in detail. A method of analysis consisting of replacing any multilayer system by one layer with two effective interfaces is used to explain the operation of band-pass and low-pass filters. Methods of making experi-

mental filters are discussed, including the experimental difficulties involved. An example of a five layer experimental filter is given. *Subject Headings:* **1. Interference filters 2. Infrared radiation filters.**—*Author's abstract.* Ⓢ

11.10–240 551.508.71:551.501.771

Farkel, Werner, **Dampfdruckbestimmungen in beliebiger Atmosphäre bei höheren Temperaturen.** [Vapor pressure measurements in atmospheres at high temperatures.] *Die Naturwissenschaften*, Berlin, 47(1):10–11, Jan. 15, 1960. fig., ref. **DLC**—In order to overcome some difficulties in these measurements, the author proposes a solution consisting in dividing the volume by a small vessel with a ball-valve. The published curves show the action of the ball-valve on the thermal dissociation of $PbCO_3$ into PbO and CO_2. The curves have been measured by an automatic differential thermobalance. The sample divided by the ball-valve shows the same reaction as a sample in a pure CO_2 atmosphere. By displacements of the O-point during measurements it is possible to determine the curves with a good precision. More exact details will be published in a following article. *Subject Headings:* **1. Vapor pressure measurement techniques 2. Thermal chemical dissociation.**—*A. V.* Ⓢ

11.10–241 551.508.765:551.509.324:551.574.1

Singleton, F. (*Met. Res. Flight, Farnborough*), **Aircraft observations of rain and drizzle from layer clouds.** *Royal Meteorological Society, Quarterly Journal*, 86(368):195–204, April 1960. 5 figs., table, 7 refs. **DWB, DLC**—Aircraft observations of droplets greater than 100μ in diameter in 20 low layer clouds indicate that these drops can occur in concentration of approximately 0.1 per liter to 10 per liter in clouds of 1000 ft (300 m) to 7,000 ft (2100 m) thickness. These observations are presented together with data relating the thickness and height of a further 120 layers of low cloud to their ability to produce precipitation at the ground. A diagram is shown which, it is suggested, might be of use as an objective aid for forecasting the occurrence of precipitation from low-layer cloud. The results are discussed qualitatively in terms of the condensation-coalescence mechanism of droplet growth and demonstrate the efficiency of layer clouds as producers of large drops (and consequently precipitation). There is evidence that, for the range of cloud depths considered, coalescence is the predominant mechanism for drop growth for temperatures down to −11°C to 12°C. *Subject Headings:* **1. Raindrop observation in clouds 2. Precipitation forecasting 3. Droplet coagulation.**—*Author's abstract.*

11.10–242 551.508.822:621.396.61

Shteĭn, N. I. and Orlova, Z. P., **Issledovanie rezhima ul'trakorotkovolnovykh radioperedatchikov tipa PRB-1.5.** [Investigation of the regime of ultra-short wave radio transmitters of the type PRB-1.5.] *Leningrad. Nauchno-Issledovatel'skiĭ Institut Gidrometeorologicheskogo Priborostroeniia, Trudy*, No. 7:85–91, 1959. 5 figs., table. **DWB**—In this study of the ultra-short wave PRB-1.5 radio transmitter the authors investigated the following problems, namely: verification of the stress magnitudes upon the contacts that are manipulated and the verification of the stability of frequency of impulse succession, the energy relationships and other electrical parameters. The transmitter operates in a regime of automodulation since the frequency of impulse succession depends on the fact whether or not the signals of the meteorological units are transmitted by radio. In the transmission of the signals of the meteorological units of the radiosonde the frequency of impulse succession is of the order of several hundred impulses per second; in the absence of such signals the impulse succession frequency exceeds 3000 impulses per second. Data on the electrical characteristics of the transmitter based on studies of 5 transmitters shows the following: (1) the scatter in the values of constant constituent currents in the anode relays and of the values of the grids of the power conducted and in the values of power given off by lamps in the load may attain values of 50 to 60% between individual transmitters; (2) the scatter in the value of the manipulating potential may amount to 25%; (3) the scatter in the values of the frequency of impulse succession reaches 90% when the capacity of the autodisplacement relay is $C_e = 0.06$ m.c.f. and 30% when $C_e = 0.01$ m.c.f.; (4) the variation of the capacity in the relay of autodisplacement C_e does not influence the average value of the constant components of the grid currents but affects greatly the

frequency of impulse succession. The influence of external factors upon the frequency of impulse succession is indicated by the fact that the latter depends upon variations of the distance between the transmitter and metallic foil. The frequency of impulse succession depends greatly upon the magnitude of the constant potential and to a lesser extent upon that of the incandescence. The dependence of the impulse succession frequency upon the resistance of autodisplacement and the evidenced hysteresis, etc. are discussed. *Subject Heading:* **1. Radiosonde transmitters.**—*I.L.D.*

11.10–243 551.508.99:539.16

Lox, F. F. M. and Van Der Kelen, G. P. (*both, Ghent University, Belgium*), **Contribution à l'étude du phénomène de vieillissement des compteurs Geiger-Muller autocoupants.** [Contribution to the study of the ageing phenomena of Geiger-Muller counters.] *Journal de Physique et le Radium*, Paris, 20(12):131A–138A, Dec. **1959.** 7 figs., 3 tables, 14 refs., French and English summaries. **DLC**—As an unambiguous criterion for determining the deterioration of a Geiger-Muller counter tube, the value $\Delta V_I/\Delta V_H$, the change in pulse frequency as a function of the applied high voltages, has been defined. A study was made of the relative importance of the three main constituents of a G.M. counter on its characteristics. A systematic study was made of the influence of anode, cathode and of the gas-phase composition. It is shown that the bad functioning of an aged counter can be ascribed to two different factors: changes of the gas phase, that influence mainly the background characteristics and change of the anode surface that causes a gradual decrease of the value $\Delta V_I/\Delta V_H$. This is taken as evidence that the changes of the anode surface influence the multiplication process. *Subject Heading:* **1. Geiger counters.**—*Authors' abstract.* Ⓢ

11.10–244 551.501.7:523.5:551.510.42:551.508.91

Villermaux, J., **Sur une méthode d'étude de poussières météoriques.** [A method of studying meteoric dust.] *L'Astronomie*, Paris, 73(3):129–132, March **1959.** 2 figs., 3 refs. **DLC**—Description of the equipment and method used to collect the meteoric dust which reaches the ground only when beaten down by rain. The equipment is composed of a collector consisting of a large revolution funnel linked up with a rain gage by means of a polythene tubing. Dust is stopped in the tube through a magnetic selector consisting of permanent magnets. Author believes he could present a relationship between the amount of dust collected and the yearly distribution of major meteoric streams. *Subject Headings:* **1. Meteoric dust collectors 2. Meteoric dust hypothesis.**—*A.V.* Ⓢ

11.10–245 551.508.952

†Glaser, Arnold H.; Hatch, Frederic E. and Stevens, William, Jr., **An evaluation of ozonesondes.** Allied Research Associates, Inc., Boston, Contract AF 19(604)-3493, Final Report, Feb. 29. **1960.** 91 p. 28 figs. (incl. photos), 97 refs., eqs.—Available sounding instruments capable of measuring atmospheric ozone are evaluated to ascertain their suitability for use on a semi-routine basis over an extended network. The Paetzold ozonesonde is an optical instrument which determines the amount of ozone between the sonde and the sun by differential absorption of two ultraviolet wave lengths. The instrument is moderately complicated but is not difficult to operate and appears to be reliable. Data reduction, on the other hand, requires a great measure of skill and considerable time. Subjective procedures in the reduction make it difficult for inexperienced personnel to construct reproducible ozone profiles. Suggested modification for extensive use in the United States would include adaptation for telemetry in a form which can be directly fed into a digital computer for automatic objective data reduction. The Mast ozonesonde is an American adaptation of the successful Brewer chemical sonde. It was found that the telemetering arrangements would not function properly when attached as prescribed to the standard radiosonde system. Modifications were made which permitted appropriate telemetering but only one of three flights showed any indication of the telemetering of ozone. The instrument proved to be relatively difficult to prepare for operation, but data reduction is relatively simple. The basic principle, utilization of the electrical energy released by the reduction of potassium iodide upon exposure to ozone, is sound. Workable instruments should be possible with appropriate modifications. This sonde is potentially

the cheapest of the sondes evaluated to both construct and operate. The Regener ozonesonde carries the standard potassium iodide-sodium thiosulfate titration of ozone into sonde form. The resulting instrument is quite elegant but somewhat complicated. Flight tests were not performed because of federal air space restrictions. The sonde appears to be relatively difficult to prepare for launch and data reduction is slightly more difficult than in the case of the Mast sonde. Further development of any of these sondes seems to be required for extended network use. It would appear that the required development can most readily be accomplished with the Paetzold principle. *Subject Heading:* **1. Ozonesonde comparisons.**—*Author's abstract.* Ⓢ

11.10–246 551.508.952

Moreland, W. B. (*Met. Physics Section, Office of Met. Research, U. S. W. B.*), **Report on ozonesonde intercomparison tests.** Wash., D. C., U. S. Weather Bureau, Jan. 1960. 82 p. numerous figs., 2 tables, 16 refs. **DWB** (M08.952 U587re) —These ozonesonde intercomparison tests on vertical ozone distributions include reports on 162 observations made during daylight hours and 11 flights on the same mission, during April 13, 1959 and May 1, 1959. Investigations were made from Lowry Air Force Base, Denver, in order to determine, on a comparative basis, the amount and variations of atmospheric ozone over various points. In each of the flights the following were determined: the stratospheric ozone, jet stream axis, ozone profiles, cyclonic circulation as well as the relative intensities of winds, temperatures, frost and the pressure system. These are evaluated, graphed and discussed. *Subject Headings:* **1. Ozonesonde comparisons 2. Vertical ozone distribution measurement techniques 3. Denver, Colo.** —*N.N.* Ⓢ

11.10–247 551.508.96:06.045

Raff, S. J.; Parker, M. J.; Snavely, B. L. et al., **Report on Phase I of the Feasibility Committee for 200,000 foot altitude instrumented HASP.** *U. S. Naval Ordnance Lab., White Oak, Md., NAVORD Report,* 6763, Dec. 15, 1959. 89 p. 33 figs., tables, 30 eqs., refs. **DWB** – There is very little atmospheric information available above 100,000 feet, and the requirements of Military and other programs which will use such information are not defined in such a way as to justify firm accuracy goals. It is recommended that a transponding sonde (x-band or 403 megacycle) be developed and that the final selection of sensors for a mass produced sonde be preceded by flight tests to evaluate the most promising sensors. For initial flights the Committee recommends a bead thermistor, for temperature sensing and a single point pressure indicator to operate at 50,000 to 80,000 feet. A number of suggestions are made for other types of temperature and pressure sensors which might be developed for later models. The Committee sees a need for further effort on: (a) descent devices, (b) the ROBIN balloon device, which might fulfill the HASP requirement without the use of electronics, and (c) the HASP wind tunnel. It is felt that firing of the telemetering only (non-transponding) rounds designed for lower altitudes will yield information useful to the present HASP objectives. The Committee also believes that the HASP program would benefit from association with a modest program of upper atmosphere research. *Subject Headings:* **1. Radiosonde development 2. Upper atmosphere instruments.**—*Author's abstract.* Ⓢ

SYNOPTIC ANALYSIS AND FORECASTING

See also: **Ten-millibar weather maps July 1957-June 1958** (U. S. Weather Bureau), 11.10–230; **Rain and drizzle from layer clouds** (Singleton), 11.10–241; **Synoptic analysis of ozone variations over British Isles** (Martin, Brewer), 11.10–267; **Nonlinear computational instability** (Phillips), 11.10–272; **Arctic circulation studies** (Reed), 11.10–287; **Utilization of solar energy** (Schüepp), 11.10–307, 11.10–308; **Transport of radioactive particles** (Haarländer), 11.10–340; **Climate of mountain slopes** (Podol'skiĭ), 11.10–380; **Weather typing with regard to dynamic climatology** (Rein), 11.10–383

11.10–248 551.509.312:551.513.2:551.515.8

Thompson, Philip Duncan (*Joint Numerical Weather Pred. Unit, Wash., D. C.*), **Some statistical aspects of the dynamical processes of growth and occlusion in simple baroclinic**

models. (In: Bolin, Bert, ed., **The atmosphere and the sea in motion.** N. Y., Rockefeller Institute Press, **1959.** p. 350–358. 2 figs., 8 refs., 22 eqs.) **DLC**—By combining the vorticity and continuity equations for the general two-level model, it has been found possible to derive relatively simple expressions for the average rate of growth for increase of rotational energy and the average rate of occlusion of large-scale baroclinic disturbances. The growth rate depends primarily on the area correlation between the vertical air speed and the deviation of the temperature from its zonal average; the rate of occlusion depends on the area correlations between the vertical air speed and the deviations of both temperature and pressure from their zonal averages. At least in cases when the horizontal velocity field is independent of the north-south coordinate, it is found that disturbances in which the temperature field precedes the pressure field tend to die out undetected. Disturbances in which the temperature field lags behind the pressure field, on the other hand, grow in amplitude as long as they maintain that phase relationship. Simultaneously and as a dynamical consequence of the growth process, the temperature field in such disturbances gradually catches up with the pressure field, and the flow approaches a state of quasi-barotropy. At the instant this state is reached, growth ceases and there is no further change in the relative phase of the pressure and temperature fields. In the absence of heating and viscosity, the flow would tend to remain quasi-barotropic, verifying an hypothesis proposed by Rossby almost twenty years ago. *Subject Headings:* **1. Large scale weather processes 2. Baroclinic disturbances.**—*Author's abstract.*

11.10–249 551.509.312:551.509.33

Cressman, George P. (*Numerical Weather Pred. Unit., Wash., D. C.*), **Hemispheric non-divergent barotropic forecasting.** (In: Bolin, Bert, ed., **The atmosphere and the sea in motion.** N. Y., Rockefeller Institute Press, **1959.** p. 475–485. 24 figs., 10 refs.) **DLC**—The initial results of the hemispheric barotropic forecasts computed by the Joint Numerical Weather Prediction Unit of the United States are described. The model uses a non-divergent, non-geostrophic wind, and includes the large-scale effects of terrain. Verifications and examples characteristic of the first few months' experience with the program are presented. The success achieved by a barotropic model of the atmosphere is regarded as a vindication of the opinions of Professor Rossby. The forecasts deteriorate noticeably by about three days as a result of inadequate treatment of very long waves, the neglect of baroclinic effects, friction, and other factors. *Subject Headings:* **1. Barotropic models 2. Numerical models including topographic effect 3. Hemispheric forecasts 4. Joint Numerical Weather Prediction Unit.**—*Author's abstract.*

11.10–250 551.509.312

Hinkelmann, Karl (*Deutscher Wetterdienst, Offenbach*), **Ein numerisches Experiment mit den primitiven Gleichungen.** [A numerical experiment with the primitive equations.] (In: Bolin, Bert, ed., **The atmosphere and the sea in motion.** N. Y., Rockefeller Institute Press, **1959.** p. 486–500. 12 figs., 4 refs., 20 eqs.) **DLC**—A short period numerical forecast is made with a multilayer nongeostrophic model for one and/or three days. Sound waves and external gravitational waves have been filtered; combined inertial-internal gravitational waves, however, are still included in the equations. Friction and non-adiabatic effects as well as those due to the earth's curvature and to orographical obstacles, are neglected. Considered is the flow pattern within a channel being infinite with respect to the zonal coordinate, but bounded by rigid walls to the north and south. The model defines and predicts horizontal wind components and temperature at the 100, 300, 500, 700 and 900 mb levels, the vertical velocity and the geopotential gradient at the 0, 200, 400, 600, 800 and 1000 mb levels at grid points at a distance of 300 km. Initially a very simple sinusoidal barotropic disturbance, imbedded in an also simple basic zonal current, is selected. The initial data are adjusted to each other quasi-geostrophically to guarantee that no noise waves of appreciable amplitude will occur. The developing flow patterns show a very strong cyclo- and anticyclogenesis and a remarkable occlusion process of warm air within the cyclonic area, due to nongeostrophic temperature advection. The tendencies of mean zonal momentum and temperature as well as some phenomena of meridional circulation processes are studied and briefly discussed. The results show that the primitive equations can serve as useful tools for predicting large scale weather

developments. *Subject Heading:* **1. Numerical forecasting with primitive equations.** —*Author's abstract.*

11.10–251 551.509.313:551.511.3

Knighting, E. and Gilchrist, A. (*both, Met. Office, Dunstable*), **The effect of stability on computed tendencies and vertical velocities.** *Royal Meteorological Society, Quarterly Journal*, 85(366):412–414, Oct. **1959.** fig., 3 refs., 4 eqs. **DWB, DLC**—The two-parameter models used in numerical prediction of the contour height field usually assume a constant value of the hydrostatic stability, about $-0.04°C\ mb^{-1}$. The effect of varying this value over the field is investigated and it is shown that as the stability approaches zero the computed tendencies and the vertical velocities are increased. *Subject Headings:* **1. Stability change forecasting 2. Numerical forecasting.**—*Authors' abstract.*

11.10–252 551.509.313

Kuo, H. L. and Nordo, Jack (*both, M. I. T.*), **Integration of four-level prognostic equations over the hemisphere.** *Tellus*, Stockholm, 11(4):412–424, Nov. **1959.** 8 figs., 4 refs., 34 eqs. **DLC**—The three-dimensional quasi-nondivergent prognostic equation derived previously by Kuo is integrated over the hemisphere, the vertical distribution being represented by four levels. The effects of the mean radiational heating, friction and heating from the ground, and that of the turbulent diffusion have been included in this investigation. The initial disturbance considered is a random combination of ten wave components in x and seven wave components in y. The result of the integration is that at the end of the fourth day at 850 mb, three closed lows have been formed, all around latitude 60°, while the pole is occupied by a high. These lows have the dimensions of the semi-permanent lows in winter. (For abstract on this title from another source, *see* 10.8–159, Aug. 1959, *Met. Abstr.*) *Subject Headings:* **1. Numerical forecasting 2. Hemispheric forecasts.**—*Authors' abstract.*

11.10–253 551.509.323:551.524.36

Drimmel, Julius, **Vorhersage der Temperaturmaxima für beliebige Gebirgslagen bei sommerlichem Strahlungswetter.** [Forecasting temperature maxima for any given mountain exposure during clear summer weather.] *Germany. Deutscher Wetterdienst, Berichte*, 8(54): 227–230, **1959.** 2 figs., table, 6 refs. English and French summaries p. 227. **DWB, DLC**—If the amount of perceptible heat transferred from the ground to the atmosphere between sunrise and 1500 h local time is known, and if a radio sounding in the morning is available, then it is possible to compute the temperature maximum for the same location, under clear conditions. By making several reasonable simplifications, by introducing a model atmosphere based upon the temperature field at the 850 mb level, and by definition of an "effective heating level" one can derive a daily maximum temperature forecast for any location and altitude, provided there is no advection and clear summer weather prevails. *Subject Headings:* **1. Maximum temperature forecasting 2. Altitude effects on temperature.**—*Author's abstract.*

11.10–254 551.509.5

†Bergeron, Tor (*Univ. Uppsala*), **Methods in scientific weather analysis and forecasting. An outline in the history of ideas and hints at a program.** (In: Bolin, Bert, ed., **The atmosphere and the sea in motion.** N. Y., Rockefeller Institute Press, **1959.** p. 440–474. 12 figs., 2 tables, 184 refs.) **DLC**—Since the first attempts at scientific weather forecasting, weather prognosis has progressed mainly due to improvements of: O, the meteorological observations; T, the tool used for making the ever-increasing mass of data accessible to a purposeful mental, graphical or mathematical-mechanical treatment; M, our models of atmospheric structure and their degree of rational physical approach to the problem. The development of the above factors is treated, from Dove's local method till today's mechanical-numerical calculations of upper flow-patterns. It is shown that progress has been severely impeded by lack of contact between theory and empirical results. Long-awaited radical improvement of weather forecasts will presumably largely depend on still inconceived fundamental ideas especially as to the factors O, T and M, also making them more directly related to weather, and on a better utilization of these factors. *Subject Headings:* **1. Weather analysis 2. History of weather forecasting 3. Forecast improvement.**—*Author's abstract.*

ARTIFICIAL PRECIPITATION

See also: **Visibility in fog and its artificial modification** (Israël, Kasten), 11.10–362.

11.10–255 551.509.615:551.575:536.421

Soulage, G., **Précipitation de brouillards surfondus au moyen de neige carbonique.** [Precipitation of supercooled fog by means of dry ice.] *Puy de Dôme. Observatoire, Bulletin*, No. 4:147–149, Oct./Dec. **1959.** 10 refs. **DWB**—Dry ice, silver iodide and propane are the principal cold-producing substances which were used during tests for supercooled fog precipitation. Dry ice appeared to be the least effective. With a view to verify this assertion, experiments were conducted in the region of Clermont-Ferrand. Dry ice was dispersed in the atmosphere with two liquid gas bottles, fitted on the rear platform of a light truck. The dry ice was dispersed upwards to three or four meters from the soil. The temperature of the fog varied locally from −1.5 to −4.5°C. In each case the supercooled stratus was locally transformed into ice-crystal clouds. The dry ice acts like a freezing agent very near 0°C. Certain experiments gave very light and localized precipitation, and one produced heavy snowfall followed by a great improvement in visibility. The dry ice thus permits, in certain cases, to precipitate supercooled fog as do silver iodide and propane. It has appeared that besides temperature and wind, the stability and turbulence factors play an important part in the precipitation and dissipation of supercooled fogs. The qualitative results obtained appear to indicate that no important difference in effectiveness exists between dry ice and propane. Silver iodide however seems to have a more extended and more regular action but it requires lower temperatures (inferior to −4°C). *Subject Headings:* **1. Fog precipitation 2. Fog seeding 3. Fog dissipation 4. Cloud seeding effectiveness.**—*A. V.*

STRUCTURE AND PHYSICS OF THE ATMOSPHERE

DENSITY

11.10–256 551.510.5:551.510.3:551.524

U. S. Army Ballistic Missile Agency, Huntsville, Ala., **ABMA climatological ringbook, Pt. 1, Ambient temperature as a function of altitude for ten selected stations.** Its *DA Technical Report* 8-59, June 19, **1959.** 61 p. 20 tables. **DWB** (M24.35 U581d)—**Pt. 2, Ambient density as a function of altitude for ten selected stations.** Its *DA-Technical Report* 60-59, Sept. 1, **1959.** 55 p. Mostly tables. **DWB**—(M24.35 U581a)—These reports present the monthly arithmetic mean and standard deviation (Sigma) ambient temperature and density values as a function of altitude (1000–10 mb or 1–31 km) for ten selected stations which include Germany, Greenland, Guam, Hawaii, Libya, Morocco, Panama Canal Zone, Philippine Islands, and Puerto Rico. The data were compiled during the process of investigation and evaluation of atmospheric data for the establishment of Army Ballistic Missile Agency missile design criteria. *Subject Headings:* **1. Air density data 2. Vertical temperature distribution 3. Northern Hemisphere. I. Vaughan, William W.**—*Author's abstract.* Ⓢ

ATMOSPHERIC COMPOSITION

See: **Ozone chemistry and technology** (Internat. Ozone Conf.), 11.10–21; **Radioisotopes in the atmosphere** (Lal et al.), 11.10–58; **Ionized hydrogen in outer atmosphere** (Outsu, Iwai), 11.10–213; **Ion-atom interchange** (Bates), 11.10–261; **Composition of upper atmosphere** (Nicolet), 11.10–262; **Vertical ozone distribution over Arosa** (Dütsch), 11.10–264; **Problem of ozone** (Kuznetsov), 11.10–265; **Reactions in flash photolysis of ozone** (McGrath, Norrish), 11.10–266; **Day-to-day changes of ozone over British Isles** (Martin), 11.10–267; **Meridional distribution of ozone in different seasons** (Ramanathan, Kulkarni), 11.10–268; **Vertical distribution of ozone** (Walton), 11.10–270.

ATMOSPHERIC POLLUTION

See also: **Fall-out of meteoric iron particles** (Kreiken), 11.10–120; **Method of studying meteoric dust** (Villermaux), 11.10–244; **Rise of bent-over hot plumes** (Scorer), 11.10–285.

11.10–257 551.510.53:551.510.42:551.510.72

Challande, René, **Recherches sur les poussières submicroniques en altitude.** [Research on upper-air submicronic dust particles.] *La Météorologie*, Paris, Ser. 4, No. 55:235–236, July/Sept. **1959.** plate+6 figs. French, English and Spanish summaries. **DWB**—The studies pertaining to fine dust particles were carried out at the Cosmic-ray Observatory of Aiguille du Midi, at an altitude of 3616 m, in Oct. 1958. The dust particles were collected through an electrical process and photographed with an electron microscope. Statement of the method for analyzing the dust particles and for measuring their radioactivity. The upper air contains a considerable amount of submicronic dust particles (nearly a hundredth of the proportion found over flat open countries). The industrial dust particles (smokes, oxides, etc.) are exceptional, the predominating elements having a regular crystalline form. The radioactivity of the particles is slightly superior to that observed in flat open countries, but it is not impossible that the 3 nuclear explosions at high altitudes in September 1958 in the U. S. have influenced the measurements. *Subject Headings:* **1. Dust content of the upper atmosphere 2. Radioactivity in the upper atmosphere 3. Dust meters 4. Radioactivity in the atmosphere measurement techniques 5. Aiguille du Midi Observatory, France.**—*A. V.* Ⓢ

11.10–258 551.510.42(439.151) 551.586:613.15

Péczely, György (*Hungarian Met. Inst.*), **Die Luftverunreinigung in Budapest bei verschiedenen makrosynoptischen Lagen.** [Atmospheric pollution in Budapest under various large-scale synoptic conditions.] *Zeitschrift für Meteorologie*, Berlin, 13(1/6):67–68, Jan./June **1959.** 2 tables. German and English summaries p. 67. **DWB, DLC**—This paper deals with air pollution concerning urban climatic problems. Air pollution has been investigated using observations of global radiation. The rate of aerosols occurring during different weather situations is shown. Future tasks of climatological research on air pollution are outlined. *Subject Headings:* **1. Atmospheric pollution 2. Urban climatology 3. Budapest, Hungary.**—*Author's abstract.*

11.10–259 551.510.42:551.584.5(794)

Rogers, Lewis H. (*Air Pollution Foundation, San Marino, Calif.*), **Nitric oxide and nitrogen dioxide in the Los Angeles atmosphere.** *Air Pollution Control Association, Journal*, 8(2):124–128, Aug. **1958.** 8 figs., 13 refs., 4 eqs. **DLC**—Amounts of measured pollution show daily variations depending on the rate at which nitrogen oxides are emitted from motor vehicle exhausts, stacks, chimneys and other combustion processes, location of the sampling points, wind speed and direction, the height of the inversion layer, the thermal reactions of nitric oxide with oxygen, ozone and organic materials, as well as the photochemical and thermal reactions of nitrogen dioxide with ozone, sunlight, and organic materials. These factors are discussed in the present report. *Subject Headings:* **1. Atmospheric pollution 2. Nitric oxide 3. Nitrogen oxides in atmosphere 4. Urban climates 5. Los Angeles, Calif.**—*N. N.*

GENERAL STRUCTURE OF ATMOSPHERE

See also: **Meteorology of air layer near ground** (Leningrad. GGO), 11.10–1; **Radiation emerging from planetary atmosphere** (Coulson et al.), 11.10–2; **Atmosphere of Venus** (Kuiper), 11.10–103; **ABMA climatological ringbook** (U. S. Army Ballistic Missile Agency), 11.10–256; **Nonlinear differential equations of atmospheric tides** (Pekeris, Alterman), 11.10–279.

11.10–260 551.510.5(213)

Pisharoty, P. R. (*Meteor. Office, Poona*), **A standard atmosphere for the tropics (m.s.l. to 20 km).** *Indian Journal of Meteorology and Geophysics*, Delhi, 10(3):243–254, July **1959.** 2 figs., 6 tables, 16 refs., 8 eqs. **DWB, DLC**—The mean geopotential heights and temperatures

of the standard isobaric surfaces over the Asian, the Caribbean and the Southwest Pacific areas are examined. The examination reveals (1) that sufficient uniformity prevails over these regions to justify the drawing up of specifications for a Standard Atmosphere for the Tropics, and (2) that the conditions over the tropics are sufficiently different from the ICAN, ICAO and NACA Standard Atmospheres to warrant the drawing up of a separate set of specifications. Specifications for a Standard Atmosphere for Asian Tropics (SAAT) and slightly different specifications for a Standard Atmosphere for Tropics for universal use (SATU) are presented in the paper. Two computed tables, one showing the distribution of pressure and temperature with height, and the other showing the heights and temperature of standard isobaric surfaces, for both the proposed standard atmospheres are presented. *Subject Headings:* **1. Standard atmospheres for tropics 2. Standard isobaric surfaces.**—*Author's abstract.* Ⓢ

UPPER ATMOSPHERE

See also: **Thermal field of Arctic stratosphere** (McClain), 11.10–19; **Atmospheric re-entry** (Nonweiler), 11.10–32; **Range traveled in atmosphere by entry vehicle** (Cheatham et al.), 11.10–42; **Deceleration of meteors in earth's atmosphere** (Verniani), 11.10–105; **Velocity of meteors during their evaporation** (Verniani), 11.10–106; **Disturbed circulation in Arctic stratosphere** (Hare), 11.10–290; **Snow crystal forms and upper-air conditions** (Murai), 11.10–370.

11.10–261 551.510.53:541.124.7:546.17

Bates, D. R. (*Queen's Univ., Belfast*) and Nicolet, M. (*Ry. Met. Inst., Brussels*), **Ion-atom interchange.** *Journal of Atmospheric and Terrestrial Physics*, N. Y., 18(1):65–70, April **1960.** 2 tables, 19 refs., 22 eqs. **DLC**—It is argued that the ion-atom interchange processes of importance in the upper atmosphere (e.g. $O^+ + N_2 \rightarrow NO^+ + N$ and $O^+ + O_2 \rightarrow O_2^+ + O$) are very much slower than simple collision theory has led some aeronomists to suppose. The rate coefficients involved are thought to be sensitive to the temperature. Ion-atom interchange does not, as has been suggested, exercise an appreciable direct influence on the degree of dissociation of the nitrogen. *Subject Headings:* **1. Ion-atom interchange 2. Nitrogen dissociation.**—*Authors' abstract.* Ⓢ

11.10–262 551.510.53:551.524.7

†Nicolet, Marcel, **The constitution and composition of the upper atmosphere.** *Institute of Radio Engineers, N. Y., Proceedings*, 47(2):142–147, Feb. **1959.** table, 35 refs., 20 eqs. **DLC**—A general survey is made of various observations and theoretical possibilities which concern the problems involved in the study of the constitution and composition of the upper atmosphere. The basic problem of the composition of the homosphere and heterosphere is studied after considering the nature of dissociation processes and vertical transport by diffusion. Finally, the effect of thermal conduction on the temperature distribution is shown to be of importance over the entire thermosphere above the *E* layer. Analyses of satellite observations show that densities between 200 km and 800 km may have a vertical distribution as follows:

Altitude (km)	200	300	400	600	800
Density (g cm^{-3})	6×10^{-13}	6×10^{-14}	8×10^{-15}	5×10^{-16}	8×10^{-17}

Subject Headings: **1. Upper atmosphere composition 2. Photochemistry of upper atmosphere 3. Aeronomy 4. Thermosphere 5. Upper atmosphere densities.**—*Author's abstract and A.V.* Ⓢ

11.10–263 551.510.53:551.513.2

Palmer, Clarence E. (*Inst. Geophys. U. Calif., Los Angeles*), **The stratospheric polar vortex in winter.** *Journal of Geophysical Research*, Wash., D. C., 64(7):749–764, July **1959.** 10 figs., 17 refs. Notes by Jae R. Ballif, *ibid.*, 64(11):2031, Nov. **1959. DLC**—In winter the polar stratospheric air within the earth's shadow forms the core of an intense 'cold low' which extends from about 10 km to at least 50 km and possibly to the base of the ionosphere. Compared with the tropospheric general circulation, this vortex seems to be remarkably stable, particularly in the Southern Hemisphere. Recent research work in Canada and the United States

on the characteristics of the vortex is reviewed. The chief conclusions are that the vortex is more stable in the Southern than in the Northern Hemisphere, that 'explosive warmings' in the lower stratosphere of the Northern Hemisphere follow the breakdown of the vortex at high levels close to the pole, and that the breakdown extends from above downward over a period of several days. It is suggested that the high-level breakdown is correlated with solar activity. *Subject Headings:* **1. Stratospheric polar vortexes 2. Cold vortexes 3. Solar effects on general circulation. I. Ballif, Jae R.**—*Author's abstract.* Ⓢ

11.10–264 551.510.534:551.521.31

*Dütsch, Hans Ulrich (*Lichtklimatisches Obs., Arosa*), **Vertical ozone distribution over Arosa from three years' routine observation of the Umkehr effect.** Contract AF 61(514)-905, Final Report, Sept. **1959.** 24 p. 14 figs., 3 tables, 15 tables in appendix, 8 refs., eqs. English and German summaries preceding p. 1. **DWB** (M10.534 D978v)—An extensive report of 700 Umkehr curves evaluated for vertical ozone distribution on an IBM 704 computer. The curves were obtained on wave length pair C of the Dobson instrument during almost $3\frac{1}{2}$ years of routine zenith skyline observations at Arosa, Switzerland. The results of this method were compared with those of another indirect (infrared spectroscopy) and two direct methods (a chemical and an optical ozone sonde). Monthly means of vertical ozone distribution have been computed for a three year period and the annual variations of the ozone concentration at different heights has been obtained. The influence of large scale deviations from the normal circulation pattern in the lower stratosphere is shown. Finally, some typical single cases in their relation to weather situations are discussed. In the appendix the ozone concentration as a function of height for all 700 single cases is given. *Subject Headings:* **1. Vertical ozone distribution 2. Umkehr effect 3. Arosa, Switzerland.**—*I.S.* Ⓢ

11.10–265 551.510.534

†Kuznetsov, G. I., **Problema ozona.** [The problem of ozone.] *Meteorologiia i Gidrologiia*, Leningrad, No. 4:62–67, April **1959.** 2 figs., 1 table, 25 refs. **DWB, DLC**—The author reviews the literature dealing with the seasonal and latitudinal variation of the ozone content of the atmosphere. While not one of the methods described can explain the observed distribution of ozone in all its details, they do indicate that it depends upon the large scale circulation of the troposphere and lower stratosphere up to heights of at least 35 km. *Subject Heading:* **1. Ozone distribution in the upper atmosphere.**—*I.L.D.* Ⓢ

11.10–266 551.510.534:546.214:541.124.7

McGrath, W. D. and Norrish, R. G. W., **Studies of the reactions of excited oxygen atoms and molecules produced in the flash photolysis of ozone.** *Royal Society of London, Proceedings, Ser. A*, 254(1278):317–326, Feb. 23, **1960.** 3 figs., table, 10 refs., 45 eqs. **DWB**—The photolytic decomposition of ozone has been further investigated using the technique of flash photolysis. Earlier results have been extended and a detailed mechanism for the production of vibrationally excited oxygen molecules put forward. Comparative studies of the decomposition with and without traces of water present have shown that the ^1D oxygen atom must be responsible for the chain reaction in both cases. When dry ozone is photolyzed under isothermal conditions, absorption due to vibrationally excited oxygen molecules in their electronic ground states is detected. These molecules are produced by the reaction $O+O_3 \rightarrow O_2^+ + O_2$ with up to 17 quanta of vibrational energy, and are rotationally cold. When water is present, however, no absorption due to O_2^+ occurs but strong OH absorption is seen and it is shown that OH radicals are responsible for propagating the chain reaction in this case. These radicals can only be formed by the reaction: $O(^1D)+H_2O \rightarrow 2OH+O_2$, leading to chain branching. It is an interesting observation that this reaction must be preferred to that with ozone stated above. This conclusion will be examined later. Reactions of ^1D oxygen atoms with fluorine, chlorine, bromine and hydrogen have also been investigated. *Subject Headings:* **1. Ozone absorption 2. Photolitic decomposition of ozone.**—*Author's abstract.* Ⓢ

11.10–267 551.510.534:551.509(41,42)

Martin, D. W. (*Nat. Physical Lab., Teddington*) and Brewer, A. W. (*Clarendon Lab., Oxford*), **A synoptic study of day-to-day changes of ozone over the British Isles.** *Royal*

Meteorological Society, Quarterly Journal, 85(366):393–403, Oct. 1959. fig., 2 tables, 17 refs., 10 eqs. **DWB, DLC**—Two months of European ozone data are analyzed in relation to 24-hr trajectories determined from 100 mb contour charts. Significant correlations are obtained between vertical movements at 100 mb and non-advective and local changes of ozone, 100 mb temperature and 100 mb vorticity. These confirm the importance of horizontal convergence as a dynamic effect in the lower stratosphere. Further correlations are presented between these changes and the accompanying N-S displacements in an attempt to relate short-period phenomena and the observed global distribution of ozone. The results do not conform to the simple models of the atmosphere considered here. *Subject Headings:* **1. Ozone variations 2. British Isles.**—*Author's abstract.* Ⓢ

11.10–268 551.510.534:551.513.2

Ramanathan, K. R. and Kulkarni, R. N. (*both, Physical Res. Lab., Ahmedabad*), **Mean meridional distributions of ozone in different seasons calculated from Umkehr observations and probable vertical transport mechanics.** *Royal Meteorological Society, Quarterly Journal*, 86(368):144–155, April **1960.** 7 figs., 3 tables, 19 refs. **DWB, DLC**—The paper contains a study of the mean meridional distribution of ozone in different seasons. The vertical distribution of ozone at a number of stations at different latitudes in the Northern Hemisphere was worked out from the intensities of light scattered from the zenith sky on individual clear days using method B, i.e., the method of curve fitting with suitable correction for secondary scattering. Diagrams of vertical distribution corresponding 1) to high ozone amounts (frequent in winter and spring) and 2) to low ozone amounts (frequent in summer and autumn) are shown. Mean distribution diagrams are also given for the months of March, July and Nov. An important feature of the distribution is the strong increase in ozone amount in March below 18 km when the latitude increases beyond 30°. The results are discussed in relation to the idea of a poleward flow of air from the lower stratosphere and the neighborhood of the equatorial tropopause, as suggested by Dobson and Brewer from frost-point measurements over the United Kingdom. The existence of a stratospheric warm air pool over the middle latitude in winter and spring as revealed by sounding-balloon ascents is confirmatory evidence of this. The influence of the pool of cold air which exists in winter above 20 km in the stratosphere of the dark polar night is also considered. It is suggested that in winter and spring there is an ozone-regenerating cycle due to meridional circulation in the stratosphere of tropical and middle latitudes which carries air from the lower equatorial stratosphere to lower levels in the stratosphere of middle latitudes and puts back some of this accumulated air to higher levels in the equatorial stratosphere above 25 km. The more vigorous this circulation, the greater will be the rate of ozone storage in the lower stratosphere of extra-tropical latitudes. *Subject Headings:* **1. Vertical ozone distribution 2. Meridional circulation 3. Umkehr effect.**—*Authors' abstract.* Ⓢ

11.10–269 551.510.534:551.524.731

†Wiebrock, Herbert, **Diurnal temperature variation in the mesosphere.** N. Y., June **1959.** 36 p. 15 figs., 2 tables, 41 refs., eqs. Thesis (M. Sc.)-New York Univ. College of Engineering. Photostat of typescript. **DWB** (M10.534 V656di)—The new ozone absorption coefficients, determined experimentally by E. Vigroux in 1953, were used to study the absorption of solar energy and the diurnal temperature variations in the region from 30 to 80 km. The vertical ozone distribution for this region was computed from photochemical equilibrium theory with the Vigroux coefficients. An adjusted absorption per unit volume per ozone density (E_a/n_3) versus total path length (N) diagram was also prepared on the basis of the new coefficients. Computations were made for summer and winter at three latitudes: 0°, 30°N, and 60°N. The maximum heating rate was found to be 1.3°C/hr at noon at 48 km during the summer at the equator. A range of 6.3°C calculated for 49 km during the summer at the equator was the maximum diurnal temperature variation. *Subject Heading:* **1. Ozonosphere heating.**—*Author's abstract.* Ⓢ

11.10–270 551.510.534

Walton, G. F. (*Physics Dept., Queen's College, Dundee*), **Calculation of the vertical distribution of atmospheric ozone.** *Journal of Atmospheric and Terrestrial Physics*, N. Y.,

16(1/2):1–9, Oct. 1959. 4 figs., 3 tables, 7 refs., 6 eqs. DWB, DLC—The expressions which arise in the Umkehr method A of determining the vertical distribution of ozone are evaluated and depicted as a set of curves. By means of these curves zenith sky measurements with the Dobson spectrophotometer can be quickly converted into ozone distribution for any value of the total ozone amount. The method is applied to observational data from Ahmedabad and Oxford. *Subject Headings:* **1. Vertical ozone distribution 2. Umkehr effect evaluation 3. Ahmedabad, India 4. Oxford, England.**—*Author's abstract.* Ⓢ

RADIO METEOROLOGY

See: **Sec. B/3,** p. 1583.

RADIOACTIVITY

See: **Sec. B/6,** p. 1587.

MECHANICS AND THERMODYNAMICS OF THE ATMOSPHERE

See also: **Thermal convection in rotating cylinder** (Fultz et al.), 11.10–6; **Effect of stability on computed tendencies and vertical velocities** (Knighting, Gilchrist), 11.10–251; **Thermal and gravitational excitation of atmos. oscillations** (Mariani), 11.10–328; **Energy budgets under sea-breeze advection** (Lowry), 11.10–333; **Role of heat advection in formation of fog** (Koshelenko), 11.10–363.

11.10–271 551.511:532.52 551.46:532.52

Long, Robert R. (*Johns Hopkins Univ. Baltimore, Md.*), **The motion of fluids with density stratification.** *Journal of Geophysical Research,* Wash., D. C., 64(12):2151–2163, Dec. **1959.** 16 figs., 17 refs., 14 eqs. **DLC**—The mathematical complications of the theory of fluids with density stratification in a gravity field stem from the generation of vorticity in such fluid systems. Even if the fluid starts from rest and can be considered frictionless anything but the most trivial subsequent motion is rotational. Then the solution of the problem involves solution of the Navier-Stokes equations. In one particular but important case these equations can be integrated once to yield a second-order partial differential equation in the stream function, but even here the governing equation is nonlinear. It is tractable, however, in some interesting cases. A few of them are discussed and compared with experiment. Under many circumstances flow of a stratified fluid is characterized by the presence of strong velocity concentrations or jets. This phenomenon as observed in the laboratory and in atmosphere and oceans is discussed. The problem is approachable theoretically by means of boundary-layer theory. This approach is current research, and only a few results can be given. *Subject Headings:* **1. Stratified fluid flow 2. Boundary layer theory.**—*Author's abstract.*

11.10–272 551.511:551.509.312

Phillips, Norman A. (*M. I. T., Cambridge, Mass.*), **An example of non-linear computational instability.** (In: Bolin, Bert, ed., **The atmosphere and the sea in motion.** N. Y., Rockefeller Institute Press, **1959.** p. 501–504. fig., 5 refs., 8 eqs.) **DLC**—A particular example is constructed to demonstrate that the finite-difference solution of the nonlinear barotropic vorticity equation may have instabilities of a different nature than those caused by either an incorrect choice of the time increment or incorrect lateral boundary conditions. This instability arises because the grid system cannot resolve wave lengths shorter than about 2 grid intervals; when such wave lengths are formed by the nonlinear interaction of longer waves, the grid system interprets them incorrectly as long waves. The seemingly successful use of a smoothing process to eliminate this difficulty is described. *Subject Headings:* **1. Barotropic vorticity equations 2. Numerical analysis smoothing techniques.**—*Author's abstract.*

11.10–273 551.511.12:551.515.1:551.558.2

Starr, Victor P. (*M. I. T.*), **Note concerning the influence of rotation on convection.** *Tellus,* Stockholm, 11(3):360–363, Aug. **1959.** 4 refs., 15 eqs. **DLC**—A short note presenting

a simple hypothetical scheme to illustrate the action of one single factor, namely rotation in convective processes. The instance of readjustment of simple third systems is taken as a case in point. It is maintained that the principle of hydrostatic equilibrium is applicable to the large motions of the atmosphere also. Three conservation principles have been employed in the present study of the hydrostatic equilibrium—conservation of mass, conservation of vorticity, and conservation of energy. A mathematical approach has been adopted to thrash out the details. At the end 6 points have been listed in the way of conclusion. These lead to the suggestion that only the large convective units in the atmosphere (cyclones and the like) are of a scale for which the rotation is apt to be a governing factor from the energy standpoint. However, even to this rule the present paper suggests a number of reservations. *Subject Headings:* **1. Convection 2. Hydrostatic equilibrium.**—*I.S.*

11.10–274 551.511.13:551.542(262)

Bleeker, W., **The diurnal variation of the pressure field in the Mediterranean coastal areas.** *Berlin. Freie Universität. Institut für Meteorologie und Geophysik, Meteorologische Abhandlungen*, 9(1):33–42, **1960.** 11 figs., 4 refs. English summary p. 11. **DWB**—The Mediterranean area is an area with a great variety of local heat sources and sinks. The influence of differential heating will have repercussions on the pressure field, which especially in summer will undergo certain typical variations in the course of the day. There exists amongst mid-latitude analysts an opinion that the pressure field in the Mediterranean is confused and that there are many stations with wrong pressure values. This opinion does not seem to be correct. It is nearly always possible to construct a logical picture of the pressure field, if one takes the influences of the heat sources and sinks into consideration. A model is presented for the development of pressure troughs and pressure ridges in the vicinity of the coasts. This model is extended to various configurations in which the overall pressure field and the form of the coastline play a role. A series of isobaric maps demonstrates the general ideas found as a result of the study of the model. *Subject Headings:* **1. Diurnal pressure radiations 2. Heat sources and sinks 3. Mediterranean.**—*Author's abstract.*

11.10–275 551.511.13:551.515.2/8:551.558.2

†Lilly, Douglas K. (*U. S. W. B., Wash., D. C.*), **On the theory of disturbances in a conditionally unstable atmosphere.** *Monthly Weather Review*, Wash., D. C., 88(1):1–17, Jan. **1960.** 11 figs., 3 tables, 23 refs., 62 eqs. **DWB, DLC**—A perturbation model is developed which is applicable to small-amplitude moist convective disturbances of scales ranging from those of squall lines to tropical cyclones. In an extension of the works of Syono and Haque, disturbance development is studied for an atmosphere in which static stability may vary with height and with the sense of the vertical motion, being in general negative for upward motion in some substantial layer. Closed solutions for simplified cases are exhibited as well as results of numerical integration of a more realistic case. The dynamic stability criterion depends on the static stabilities in the ascending and descending currents and their dimensions and geometric relationships. Cloud-scale and meso-scale disturbances are more unstable than those of cyclone-scale, and presence of the former may tend to destroy conditions favoring development of the latter. Evaluation is made of the linearized effects of parallel convective bands, an "eye," the tropopause, nonhydrostatic motions, surface friction, and various boundary conditions. Comparison of solutions with observational features shows fair agreement in some respects, improving considerably when nonlinear effects are qualitatively considered. The disturbances are effective in transporting kinetic and potential energy outward from the actively unstable updraft. Nonlinear interactions tend to transport heat upward to modify the initial static stability distribution. A second-order dynamic stability criterion, obtained by consideration of nonlinear effects, tends to favor development of an existing finite-amplitude disturbance of tropical cyclone scale. *Subject Headings:* **1. Atmospheric disturbances 2. Vertical currents.**—*Author's abstract.*

11.10–276 551.511.13:551.551:551.554

Monin, A. S. (*Inst. of Physics of the Atmosphere, Academy of Science, USSR*), **Turbulence in shear flow with stability.** *Journal of Geophysical Research*, Wash., D. C., 64(12):2224–2225,

Dec. 1959. fig., eqs. **DLC**—The turbulence energy balance is considered under conditions of mean-flow shear and varying density stratification and it is concluded that: in a stable atmosphere the total turbulence energy is reduced; the maximum of the spectrum shifts to smaller scales; and, at heights large compared with the mixing length, the effects of the surface are negligible; the turbulence tends to be homogeneous, and the shear to be constant. On the other hand, when the atmosphere is unstable, the total energy and scale tend to increase; the surface always exerts an important influence; turbulent mixing is very intensive, and shear tends toward zero. *Subject Headings:* **1. Energy balance 2. Atmospheric turbulence 3. Shear stress.**—*Author's abstract.*

11.10–277 551.511.2:551.573.1 551.524:551.526.6

†Bunker, Andrew F. (*Woods Hole Oceanographic Inst.*), **Heat and water-vapor fluxes in air flowing south-ward over the western North Atlantic Ocean.** *Journal of Meteorology*, Boston, 17(1):52–63, Feb. 1960. 3 figs., 5 tables, 21 refs., 5 eqs. **DWB, DLC**—Turbulent transports of sensible heat and water vapor have been measured from an airplane within southerly-flowing air masses over the western North Atlantic Ocean. It is found that the lower levels of these air masses are unstable and warmed by the transport of heat from the water below, while the higher levels are stable and warmed by diffusion from the subsidence-inversion air aloft. Average values of the upward flux of sensible heat were found to be 2.1 mcal cm^{-2} sec^{-1} in the middle latitudes and 0.1 mcal cm^{-2} sec^{-1} in the tropics. The downward heat flux was 0.3 mcal cm^{-2} sec^{-1} in the region above the potential temperature minimum formed between the warm air aloft and the water-warmed air below. The flux of latent heat of condensation in the form of water vapor was found to be less than the flux of sensible heat from the ocean in the middle latitudes within 300 km of the east coast and about one order of magnitude greater than the sensible flux farther offshore and in the tropics. The observations are discussed in relation to various theories of heat transport and the process by which the atmosphere accumulates heat from the earth's surface. *Subject Headings:* **1. Heat transport 2. Water vapor measurements 3. Turbulence measurements in flight 4. Heat exchange sea-atmosphere 5. N. Atlantic Ocean.**—*Author's abstract.*

11.10–278 551.511.2:551.513.1

Holmboe, Jörgen (*Univ. Calif. Los Angeles*), **On the behaviour of baroclinic waves.** (In: Bolin, Bert, ed., **The atmosphere and the sea in motion.** N. Y., Rockefeller Institute Press, **1959.** p. 333–349. 7 figs., 7 refs., 10 eqs.) **DLC**—Professor Rossby's discovery of the dynamic importance of the planetary vorticity gradient is one of the great landmarks in the theory of atmospheric motion. All later developments of the theory have been influenced and stimulated by this discovery. It is an honor to pay tribute to the memory of this great man and friend. *Subject Headings:* **1. Baroclinic waves 2. Atmospheric motion 3. Planetary circulation 4. Rossby's vorticity theory.**—*Author's abstract.*

11.10–279 551.511.2:551.543.1:551.510.5

Pekeris, Chain Leib and Alterman, Z. (*both, Dept. Math. Weizmann Inst., Rehovot, Israel*), **A method of solving the nonlinear differential equations of atmospheric tides with applications to an atmosphere of constant temperature.** (In: Bolin, Bert, ed., **The atmosphere and the sea in motion.** N. Y., Rockefeller Institute Press, **1959.** p. 268–276. 4 refs., 114 eqs.) **DLC**—The purpose of this investigation is to develop a method of including the quadratic terms of the differential equations in the theory of atmospheric tides. The method is illustrated by applying it to the problem of determining the effect of the quadratic terms on the free period of oscillation of an atmosphere of constant temperature. In order not to encumber the exposition of the method by the complexity of the calculations, a simplification is introduced by treating a mode of semi-diurnal oscillation which is independent of longitude. The effect of the quadratic terms on the free period turns out to be small. This was to be expected, since in an atmosphere of constant temperature the energy-density of oscillation decreases exponentially with height, the wave-energy in a column above the level where the quadratic terms become equal to the retained linear terms being only of the order of 10^{-4} of the wave energy in the whole atmospheric column. The bearing of this result on the effect of the

quadratic terms on the oscillation of an atmosphere in which the temperature increases with height in the region where the quadratic terms are dominant is discussed. *Subject Headings:* **1. Atmospheric tides 2. Semidiurnal atmospheric oscillations.**—*Author's abstract.* Ⓢ

11.10–280 551.511.32:551.558.21:551.543.1

†Pyle, Robert L. (*Wash. Univ.*), **The diurnal pressure oscillation on a heated mountain island.** *Journal of Meteorology*, Boston, 16(5):467–482, Oct. 1959. 6 figs., table, 21 refs., 47 eqs. **DWB, DLC**—A theory is developed for the 24-hr component of the diurnal pressure oscillation and compared with observations on Haleakala Mountain, Hawaii. Using the linearized hydrodynamic equations, the theory for flow over an unheated mountain is combined with the theory for flow over a flat heated island and applied to a diurnally heated mountain ridge of infinite extent perpendicular to an undisturbed current. An appropriate heating function is deduced whose variation in the vertical embodies the eddy conduction of heat. The development is also applied to an infinite ridge oriented parallel to the undisturbed current. The two ridge models are then superposed to obtain a surface more closely approximating an isolated mountain, and the distribution of the pressure perturbation over this surface is calculated. Measurements of the 24-hr component of the diurnal pressure oscillation at ten stations on Haleakala are presented. It is demonstrated that an accurate measure of the 24-hr component may be obtained from only two weeks of continuous pressure data. Except near the trade inversion, the time-dependent portion of the pressure perturbation predicted by theory agrees closely with the Haleakala observations on both the order of magnitude and the smaller features of the distribution of the 24-hr component. The elevation at which the phase changes abruptly by 180 deg is excellently predicted. *Subject Headings:* **1. Diurnal pressure oscillations 2. Orographic turbulence.**—*Author's abstract.*

11.10–281 551.511.33:551.552:551.524(262)

Bleeker, W., **Some climatological remarks about the field of flow and temperature over the Mediterranean Sea.** *Berlin. Freie Universität. Institut für Meteorologie und Geophysik, Meteorologische Abhandlungen*, 9(1):51–76, 1960. 19 figs., 5 refs. English summary p. 11. **DWB**—The discussion centers around the field of flow in the Mediterranean area. From the streamlines and the isotachs it is clear that dynamical influences are important; it is however also immediately clear that there are important thermodynamical influences of monsoonal character. This brings us to the study of the vergence. This vergence is an interesting climatological factor since it tells us something about the upward and downward motion in the atmosphere. After having presented curves of the annual variation of the vergence, the vergence field in various months is discussed. It appears that the distribution land-sea and the temperature field over the sea control the vergence field. *Subject Headings:* **1. Thermodynamics of the atmosphere 2. Convergence and divergence 3. Temperature over oceans 4. Mediterranean Sea.**—*Author's abstract.*

11.10–282 551.511.6:551.551.2:551.557:551.542.1

Lettau, Heinz H. (*Univ. of Wisconsin*), **Wind profile, surface stress and geostrophic drag coefficients in the atmospheric surface layer.** *Advances in Geophysics*, N. Y., Vol. 6, pub. 1959. p. 241–257. 10 figs., 17 refs., 9 eqs. **DWB, DLC**—An important problem in meteorology is to establish relationships between the turbulence characteristics of the lower atmosphere and the large-scale synoptic parameters. A significant turbulence characteristic is the surface stress or ground drag which determines—together with the roughness length of the surface—the wind profile, the eddy diffusivity, and the local energy dissipation in the atmospheric surface layer. A significant large-scale synoptic parameter is the geostrophic speed as derived from the horizontal pressure gradient near the earth's surface. The geostrophic drag coefficient is defined which determines also the ratio of wind speed in the surface layer to the geostrophic speed. Its dependence on surface roughness (surface Rossby number) is investigated, and compared with similar drag relationships in fluid mechanics (duct flow). The effect of thermal stratification (Richardson number) on surface stress and wind profile structure is also discussed. *Subject Headings:* **1. Wind profiles 2. Surface roughness effects on wind 3. Turbulence theories.**—*Author's abstract.*

11.10–283 551.511.6:551.551.2

Panofsky, Hans. A. and Deland, Raymond J. (*both, Penn. State Univ.*), **One-dimensional spectra of atmospheric turbulence in the lowest 100 metres.** *Advances in Geophysics*, N. Y., Vol. 6, pub. **1959.** p. 41–64. 16 figs., 24 refs., eqs. **DWB, DLC**—This paper summarizes our knowledge of one-dimensional spectra of atmospheric turbulence in relation to each other, and to easily measured parameters. TAYLOR'S hypothesis regarding equivalence of Eulerian time and space spectra seems to be well satisfied in homogeneous turbulence. Lagrangian correlation functions have generally longer time scales than Eulerian functions, but approximately similar shapes. The spectra of the longitudinal and lateral velocity components can be divided into low-frequency "convective" and high frequency "mechanical" portions. The former is sensitive to changes in lapse rate, particularly in the case of the lateral component. The mechanical portion is sensitive to wind and surface roughness. The spectrum of vertical motion seems to have essentially the same shape at all heights, but shifts to lower frequencies with increasing height. The shape is independent of wind, roughness and lapse rate in the surface layer. However, the magnitude is strongly influenced by these parameters. *Subject Heading:* **1. Turbulence spectra.**—*Authors' abstract.*

11.10–284 551.511.6:551.524.4:551.554

Priestley, C. H. B. (*C. S. I. R. O. Div. of Met. Physics, Australia*), **Estimation of surface stress and heat flux from profile data.** *Royal Meteorological Society, Quarterly Journal*, 85(366):415–418, Oct. **1959.** 2 tables, 8 refs., 4 eqs. **DWB, DLC** —The problem of estimating shearing stress from the wind profile in the lowest layers is discussed from the operational viewpoint. It is concluded that wind-profile data alone may never in practice be sufficient, even though a universal profile with the stress as a separable parameter may be established by future research. On the other hand the determination of both stress and heat flux, with adequate accuracy, may be possible from single values of temperature gradient and wind gradient observed simultaneously. A difficulty common to all indirect methods lies in interpreting the sampling variations. *Subject Headings:* **1. Heat flux 2. Shear stress.**—*Author's abstract.*

11.10–285 551.511.6:551.551.2:551.510.42:628.53:697.8

Scorer, R. S. (*Dept. of Math., Imperial College, London*), **The rise of bent-over hot plumes.** *Advances in Geophysics*, N. Y., Vol. 6, pub. **1959.** p. 399–411. 6 refs., 39 eqs. **DWB, DLC** – By dimensional analysis the behavior of certain plumes and jets can be broadly predicted in form. The numerical constants associated with the form have to be measured, and there seems to be little justification for a more sophisticated theory. On this simple basis therefore, formulae (which are enclosed in boxes in the text) are devised to give the increase in equivalent chimney height due to upward momentum and buoyancy possessed at the chimney mouth. They apply only to an atmosphere of uniform potential temperature with a wind in which the amplitude of the ambient turbulence is a prescribed fraction of the wind. Among other things they indicate that an increase in efflux velocity produced by narrowing a chimney mouth may decrease the equivalent chimney height under certain circumstances as had been predicted by BOSANQUET. It is argued that the case of a stably stratified atmosphere cannot be treated by these methods. *Subject Headings:* **1. Stack effluent diffusion 2. Smoke plume behavior.** —*Author's abstract.*

11.10–286 551.511.6:551.551

Tchen, Chan-mou (*Nat. Bureau Stands., Wash., D. C.*), **Diffusion of particles in turbulent flow.** *Advances in Geophysics*, N. Y., Vol. 6, pub. **1959.** p. 165–174. 9 refs., 31 eqs. **DWB, DLC**—The turbulent diffusion of particles is studied on the basis of statistical mechanics of the many-body problem. The coefficient of diffusion is calculated explicitly in terms of the interaction mechanism. Existing mathematical models of turbulent diffusion are compared and discussed. In order to elucidate further the non-linear interactions, the moment equations are used. Finally with the use of Heisenberg's hypothesis of eddy diffusivity and phase considerations, a diffusion equation involving the eddy size is obtained. The solution shows that the turbulent dispersion occurs at a faster rate than the molecular diffusion, and depends

explicitly on the eddy size. *Subject Headings:* **1. Turbulent diffusion theories 2. Diffusion of particles.**—*Author's abstract.*

GENERAL CIRCULATION

See also: **Thermal convection in rotating cylinder** (Fultz et al), 11.10–6; **Growth and occlusion in baroclinic models** (Thompson), 11.10–248; **Stratospheric polar vortex in winter** (Palmer), 11.10–263; **Meridional distribution of ozone** (Ramanathan, Kulkarni), 11.10–268; **Heat and vapor fluxes southward over western N. Atlantic** (Bunker), 11.10–277; **Baroclinic waves** (Holmboe), 11.10–278; **Solar corpuscular influence on circulation at 300 mb** (Macdonald, Roberts), 11.10–320.

11.10–287 551.513.1(98) 551.509.55:551.591:551.578.45

†Reed, Richard J., **Arctic circulation studies.** Washington (State). Univ. Dept. of Meteorology and Climatology, Contract AF 19(604)-3063, Final Report, Sept. **1959.** 57 p. 6+12 figs., 6 tables, 35 refs. **DWB**—The present report entitled **The Arctic Circulation in Summer** based on data for the five summers 1950–1956 summarizes the major results of a number of studies including research work undertaken in connection with a Master's thesis. Shorter summaries are given of significant results of the experiments on dynamical predictions and of studies dealing with the water mass budget of Greenland, and the problem of depicting the surface air flow in regions of mountainous terrain. Brief mention is made of two incomplete studies, one studying strong local winds in the Arctic with particular reference to Barter Island. The second is concerned with the attempt to devise an objective forecast diagram for predicting visibility reduction due to blowing snow. Numerous charts and graphs illustrate the text. *Subject Headings:* **1. Arctic circulation 2. Visibility forecasting 3. Snowfall-visibility relationships 4. Arctic.**—*I.S.*

11.10–288 551.513.2:551.510.528:551.557.5(262)

Sutcliffe, R. C., **The Mediterranean in relation to the general circulation.** *Berlin. Freie Universität. Institut für Meteorologie und Geophysik, Meteorologische Abhandlungen*, 9(1):125–133, **1960.** 7 figs. English summary p. 17. **DWB**—The position of the Mediterranean relative to the main planetary zones and to the monsoonal circulation is briefly noted. The basic model of quasi-permanent sub-tropical jet stream and a highly disturbed polar front jet stream system is reviewed in the light of monthly mean upper air data up to 100 mb. The cellular rather than purely zonal character of the circulations is emphasized. Attention is then directed to the upper air circulation and tropopause characteristics in the Mediterranean area illustrated by charts of mean tropopause heights, mean contours and meridional cross section. Statistics on upper winds and temperatures and their variability for a few Mediterranean stations are given. It appears that Mediterranean conditions, in relation to forecasting for high level jet aircraft in the high troposphere and low stratosphere, are complicated often with two jet streams and three tropopauses with rapid transitions from one to the other. For maximum success in high level forecasting it will be necessary to make the maximum use of a limited amount of data. Regular charts of tropopause topography and cross sections to identify the jet streams and regions of large temperature gradient should be valuable aids and may prove essential. *Subject Headings:* **1. Upper air circulation 2. Mediterranean circulation 3. Jet stream variations 4. Forecasting for jet aircraft 5. Mediterranean.**—*Author's abstract.*

11.10–289 551.513.7:551.515.8:551.557.5

Bleeker, W., **Fronts and the jet stream: the front as a circulation system.** *Berlin. Freie Universität. Institut für Meteorologie und Geophysik, Meteorologische Abhandlungen*, 9(1):85–93, **1960.** 5 figs., 2 refs. English summary p. 12. **DWB**—In order to come to better understanding of what goes on in a front, consideration is given to the model developed in the lecture on the diurnal variation of the pressure field in the Mediterranean. There is in reality no difference between a sea breeze front and a stationary front developing along the coastline of a snow-covered continent. The trough of low pressure is linked with a region of strong pressure gradients aloft where the jet stream develops. The front should be considered as a circulation system; the convergence at the surface has to be compensated by the divergence aloft. A more or less stationary system may be carried away. Front and jet stream remain

coupled together. The zone of baroclinity is the real front. Inversions have often been mistaken for fronts which explains the frequent misinterpretations of the frontal theory. *Subject Headings:* **1. Frontal circulation 2. Jet stream—frontal relationships.**—*Author's abstract.*

11.10–290 551.513.1:551.510.53(98)

Hare, F. Kenneth (*McGill Univ.*), **The disturbed circulation of the Arctic stratosphere.** *Journal of Meteorology*, Boston, 17(1):36–51, Feb. **1960.** 18 figs., 29 refs. **DWB, DLC**—The annual cycle of disturbed circulation in the Arctic stratosphere (i.e., areas north of the main jet-core of the Ferrel westerlies) is discussed in the light of the climatological and synoptic evidence. In summer, the Ferrel westerlies and their wave-trains choke off with height to a zero-level near 50 mb. Because of the warmth of the Arctic stratosphere, easterly anticyclonic flow is continuous at higher levels. In August, cooling begins, and by September a barotropic westerly vortex, continuous with the Ferrel vortex, is established. In October and November, this vortex becomes baroclinic and appears distinct from the Ferrel westerlies. Winter circulation has two aspects: 1) warm, barotropic, anticyclonic flow associated with a strengthening and extension of the Alaskan warm ridge, which extends to above 25 mb; and 2) cold-low development near the pole, with a marked tendency for the development of a cold trough over eastern Canada. Polar-night jet-streams and travelling baroclinic waves characterize the outer parts of the cold-lows. The thermal waves associated with these disturbances often have large amplitudes and normally affect the entire stratosphere. The apparent independence of stratospheric disturbances centered above 50 mb is examined, and the probable physical and dynamical processes involved are tentatively discussed. *Subject Headings:* **1. Atmospheric circulation disturbances 2. Arctic stratosphere 3. Arctic circulation 4. Arctic.**—*Author's abstract.* ©

11.10–291 551.513.1:551.557.3

Rao, Y. P. (*Regional Met. Center, Madras, India*), **Interhemispherical features of the general circulation of the atmosphere.** *Royal Meteorological Society, Quarterly Journal*, 86(368):156–166, April **1960.** 7 figs., 8 tables, 7 refs. **DWB, DLC**—Mean meridional wind components in the troposphere are computed at five stations along the Equator. Their significance is discussed in regard to mass exchange between the hemispheres. The eddy transport of heat across the Equator is found to be negligible. The possibility of seasonal exchange of heat between the hemispheres through meridional circulation across the Equator is discussed. *Subject Headings:* **1. Interhemispheric circulation relationships 2. Meridional wind components.**—*Author's abstract.*

11.10–292 551.513.3:551.547.5:519.27

Namias, Jerome (*U. S. W. B., Wash., D. C.*), **Persistence of mid-tropospheric circulations between adjacent months and seasons.** (In: Bolin, Bert, ed., **The atmosphere and the sea in motion.** N. Y., Rockefeller Institute Press, **1959.** p. 240–248. 12 figs., table, 8 refs.) **DLC**—A series of analyzed mean 700 mb maps for months and seasons dating from 1932 has been used to compute fields of autocorrelation between adjacent months and seasons. While these maps embrace only the area extending from the western Pacific to Europe, they suggest regional and seasonal differences in persistence which appear to be statistically significant. Since areas of high correlation have approximately the scale of the centers of action, their explanation has a central bearing on the problem of climatic fluctuations. There seems to be some suggestion that areas of greatest persistence are linked with the sub-tropical upper level anticyclones, perhaps through reservoirs for anomalous heating or cooling provided by the underlying surface. Two cases of persistence, one involving heavy spring rains over Texas and another drought over the eastern seaboard of the United States, are described. These may indicate feed-back brought about by abnormally moist or dry soil. Finally, it is suggested that certain highly abnormal forms of the general circulation, such as a contracted circumpolar vortex in summer and an expanded circumpolar vortex in winter, are inherently stable from a hydrodynamic standpoint. *Subject Headings:* **1. Autocorrelations 2. 700 mb Northern Hemisphere mean 5-day charts 3. Persistence.**—*Author's abstract.*

ATMOSPHERIC DISTURBANCES

See also: **Typhoon rainfall at Mt. Fuji** (Arakawa), 11.10–127; **Meteorological study of origin of whistlers** (Mook), 11.10–210; **Growth and occlusion in baroclinic models** (Thompson), 11.10–248; **Influence of rotation on convection** (Starr), 11.10–273; **Disturbances in conditionally unstable atmosphere** (Lilly), 11.10–275; **Front as circulation system** (Bleeker), 11.10–289; **Intensity of precip. and freq. of electric discharges in thunderstorms** (Parczewski), 11.10–368; **Nuclei in hailstorms** (Soulage), 11.10–373.

11.10–293 551.515:521.5 551.590.23:551.594.2

Budai, Et., **Quelques observations touchant aux relations astrales de l'électricité atmosphérique.** [Some observations regarding the astral relationships of atmospheric electricity.] *Revue de Pathologie Générale.* Paris. 59 706 :361–364. March 1959. **DA, DNLM**—A parallel is drawn between exceptional meteorological phenomena hurricane, torrential rains, violent thunderstorms and conjunction of the planets Moon-Jupiter. Author mentions that in 1956, 5 natural catastrophes occurred within 5 months, in perfect synchronism with definitely determined and identical positions of planet Mars. *Subject Headings:* **1. Planetary influences 2. Weather disasters.**—*A. V.* ⑤

11.10–294 551.515.21

Malkus, Joanne S. (*Woods Hole Ocean. Inst.* and Riehl, Herbert (*Univ. Chicago*), **On the dynamics and energetics of the hurricane area.** (In: Technical Conference on Hurricanes, Miami Beach, Fla., Nov. 19–22, 1958. **Proceedings,** issued 1958 ?) Section D5 (3 p.). **DWB** (M15.2 A512pr)—A dynamic model of the lower inflow of a hurricane is presented. It is shown that maintenance of the innermost core pressures (about 963 mb) by moist adiabatic ascent requires about 12.5° increase of the equivalent temperature above the mean tropical subcloud air, the feasibility of which is tested by calculation. Rain and storm efficiency and the role of convection bands are considered and the results are compared with those of the practical aircraft reconnaissance as conducted by the NHRP. *Subject Headings:* **1. Hurricane dynamics 2. Hurricane models.**—*W. N.*

11.10–295 551.515.21:551.576.1:779

Malkus, Joanne Starr; Ronne, Claude and Chaffee, Margaret, **Cloud patterns in Hurricane Daisy, 1958.** Woods Hole Oceanographic Institution, Grant NSF 7368, Technical Report, No. 8, Jan. 1960. 48 p. 15 figs., 10 refs. **DWB** (M:551.46 W89ete —Data collected by the National Hurricane Research Project aircraft on Aug. 25, 26, and 27, 1958, during the incipient, deepening and mature days of Hurricane Daisy provide a quantitative description of cloud patterns and their role in storm dynamics and processes. Included in this data were nose camera films taken at several flight levels from which cloud maps were constructed for each of the three days studied. Comparisons were made of cumulonimbus structure, eye-wall formation, extent and height of the cirrus shield and location of rain-bands for all three days. The outstanding result of this visual cloud mapping was the persistence of lines or spiral bands of cumulonimbus in the same relative coordinate position over forty-eight hours. Two tentative hypotheses: 1) a convective quasi-accidental row location and 2) dynamic, periodic hypothesis are briefly discussed as possible explanations for the persistence of cloud structures in hurricanes. Comparison of the photographic cloud maps with radar pictures and composites selected from scope photographs taken during aircraft flights in the storm were made. This comparison proved to be extremely valuable in the interpretation of the radar echo patterns and conversely the radar pictures helped to deduce the type of cloud structure not visible during the "socked in" portions of the flights. In addition to photographic and radar data, temperature measurements were made during the flights. An attempt is made to relate the observed temperature field to the convective asymmetries of the storm. Selected areas of the 13,000' flight on the 27th were used to compare relative darkness within the cloud and temperature fluctuations. The authors also point out the danger of arbitrary temperature averaging from an incomplete azimuthal flight coverage due to the asymmetry of the storm. The conclusions drawn from this study pointed out the individual characteristics of tropical disturbances in general and the remarkable persistence of cloud patterns within hurricane Daisy even while evolving toward a symmetrical distribution about the eye. Penetrative "hot

tower" convection was extremely restricted in area and on the most active day of the storm accounted for only about 4% of the total rain area. *Subject Headings:* **1. Hurricane "Daisy" (1958) 2. Hurricane clouds 3. Cloud photographs.**—*Authors' abstract.*

11.10–296 551.515.21

Ramage, C. S., **Hurricane development.** *Journal of Meteorology*, Boston, 16(3):227–237, June **1959.** 8 figs., 2 tables, 41 refs. **DWB, DLC**—Latest available compilations confirm that mean hurricane frequencies vary widely within the tropics. Referred to a standard unit area, hurricanes (typhoons) are three times as likely to develop in the western North Pacific as in any other generating area. Numerous published analyses indicate that an intensifying upper trough in low latitudes may, through an energy dispersion mechanism, sharpen the next downstream trough. The resultant pressure fall in the downstream trough, should it overlie a low-level cyclonic disturbance, might be enough to trigger hurricane development in the disturbance. Frequent energy dispersion from a vigorous persistent upper trough in the central North Pacific could account for the high frequency of west Pacific typhoons. (For abstract of same item from another source *see* 10.7–35, July 1959, *Met. Abstr.*) *Subject Headings:* **1. Hurricane frequencies 2. Hurricane development 3. Typhoon frequencies 4. Hurricane development areas.**—*Author's abstract.*

11.10–297 551.515.3:551.556.4

Brooks, H. B. (*Thule Air Base, Greenland*), **Rotation of dust devils.** *Journal of Meteorology*, Boston, 17(1):84–86, Feb. **1960.** 2 figs., table, 2 refs. **DWB, DLC**—The writer has observed that large dust devils rotate cyclonically, at least near Tucson, Arizona. This implies that the dust devil is a central feature of a convective cell whose horizontal radius is frequently a mile. A graph of wind speed versus vortex radius is included. *Subject Headings:* **1. Dust devils 2. Tucson, Ariz.**—*Author's abstract.*

11.10–298 551.515.3:551.556.4(491.1)

Hannell, F. G. and Ashwell, I. Y., **Meteorological factors in the central desert of Iceland.** *Meteorological Magazine*, London, 87(1,038):353–364, Dec. **1958.** 5 figs., 11 refs. **DWB, DLC**—Two distinct types of dust storms rob Iceland of her already scarce dust deposits of vital importance to maintenance of the agriculture. One is the strong wind type represented by sheet of dust carried away, the other is the dust devils of small diameters borne in sunny calmer weather at times beneath cumulus clouds. Combined investigations of development of these storms and changes of meteorological conditions with increasing distance from the ice cap were conducted by the British School Exploring Society's 18th expedition. Two additional stations were established for this purpose, observing all elements hourly around the clock from Aug. 26–Sept. 1, 1956. Typical data are given graphically. It is concluded that Iceland's topology and influences of the ice cap may change beyond recognition weather conditions typical of any particular air mass. *Subject Headings:* **1. Dust storms 2. Glacier-meteorological observations 3. Iceland.**—*W.N.*

11.10–299 551.515.3(71)

McKay, G. A. and Lowe, A. B. (*both, Met. Service, Canada*), **The tornado in western Canada.** *American Meteorological Society, Bulletin*, 41(1):1–8, Jan. **1960.** 6 figs., 3 tables, 12 refs. **DWB**—Little information is available on Canadian tornadoes although from time to time these severe local storms take a serious toll of life and property. A climatology of tornadoes on the Canadian prairies is presented. These storms are most frequent in that area near the junction of the Saskatchewan-Manitoba-North Dakota borders. Compared to American tornadoes, they reach a maximum frequency both later in the day and in the season. A higher percentage move from northwest than is observed in the United States. *Subject Headings:* **1. Tornado frequencies 2. Canada.**—*Authors' abstract.*

11.10–300 551.515.31

Wagner, N. K. (*Univ. of Texas*), **A brief description and analysis of the Austin, Texas tornado of May 10, 1959.** *American Meteorological Society, Bulletin*, 41(1):14–17, Jan. **1960.** 6 figs., 3 refs., 4 eqs. **DWB** A number of meteorological measurements during the early

stage of a relatively small tornado permitted the calculation of surface-pressure and wind-speed distributions employing the conservation of momentum and the cyclostrophic wind equation. Of particular interest is the cycloid trajectory of a small cubical building which allowed an estimation of the radial wind component within the tornado. *Subject Headings:* **1. Tornado, Austin, Texas (May 10, 1959) 2. Tornado analysis.**—*Author's abstract.*

11.10–301 551.515.4(53)

Murray, R. and Coulthard, G. A., **A thunderstorm at Sharjah, Persian Gulf, on Nov. 23, 1957.** *Meteorological Magazine*, London, 88(1044):176–178, June **1959.** 4 photos, ref. **DWB, DLC**—The report of a violent thunderstorm which produced 74.1 mm of rain in approximately 50 minutes. A maximum gust of 57 knots from 030 degrees was recorded. The report is nicely illustrated by photographs of flooding at Sharjah and by charts depicting synoptic conditions and upper air soundings for Bahrain. The discussion describes the flooding and the synoptic situation over Arabia. In the end the difficult forecasting problem that such occurrences pose is pointed out. A mesoscale analysis of "western" disturbances over Arabia and the Persian Gulf is recommended. However, present facilities at the networks are reported to be inadequate for such purposes. *Subject Headings:* **1. Thunderstorm activity 2. Synoptic conditions for thunderstorms 3. Sharjah, Arabia.**—*I.S.*

11.10–302 551.515.4:551.578.7:632.117.1(43)

Schütze, G., **Das Gewitter vom 8.9. 1958 in Wittenberg und dessen Auswirkungen.** [Thunderstorm of Sept. 8, 1958 at Wittenberg and its effects.] *Zeitschrift für Meteorologie*, Berlin, 12(9/10):310–312, Sept./Oct. **1958.** 4 figs. **DWB, DLC**—The thunderstorm began at 0040h with lightning in the west. At 0127h light showers began. Within the 3 km radius the SW thunderstorm and the NW thunderstorm appeared at 0132 and 0135 respectively and by 0140 the two storms united at the zenith. The moderate shower was replaced at 0148h by intense showers with hail. The storm was closest at 0157; the shower and hail continued undiminished until 0200h; then continued as shower alone and ceased altogether at 0205h. Wind observations made at the weather station and a description of the damage in the garden of the weather station are presented with the aid of diagrams. The damage included a broken apple tree, an overturned fence and a destroyed green-house. The cause of the damage could not have been the wind with 4–5 Beaufort observed at the station but probably a tornado which proceeded from NW to SE and which had a width of 80–100 meters. The noise of the destruction was not heard during the storm. *Subject Headings:* **1. Thunderstorms 2. Tornado damage 3. Wittenberg, Germany.**—*I.L.D.*

11.10–303 551.515.8:551.557.5

Bleeker, W., **Fronts and the jetstream; historical remarks and objections to the frontal theory.** *Berlin. Freie Universität. Institut für Meteorologie und Geophysik, Meteorologische Abhandlungen*, 9(1):77–83, **1960.** 5 figs., ref. English summary p. 11–12. **DWB**—A survey is given of the objections which have been made against the classical models of warm fronts and cold fronts. The various ways in which one has tried to remedy the defects of these classical models is also critically discussed. It is pointed out that the classical models do not give us any idea about the factors which apparently govern the relation between front and jetstream. *Subject Headings:* **1. Frontal theories 2. Jet stream-frontal relationships.**—*Author's abstract.*

11.10–304 551.515.8(262)

Jansá Guardiola, J. M., **La masa de aire mediterranea.** [The Mediterranean air mass.] *Revista de Geofísica*, Madrid, 18(69):35–50, Jan./March **1959.** fig., 14 tables, 10 refs. Spanish and English summaries p. 35. **DWB**—In this work the author tries to solve the problem whether there exists a specific mass of Mediterranean air. He thinks that there is and he supposes that mass of air may come both from the subtropical air or from the polar one retained for some time in the almost closed basin of the Western Mediterranean. As an experiment he builds the Schinze diagram taking as a basis those which correspond to the two above mentioned masses when they arrive in Majorca. He comes to the conclusion that the hypothetical mass of Mediterranean air is only 2,000 m thick and that above that level it cannot be dis-

tinguished from the subtropical Atlantic air in its origin. *Subject Headings:* **1. Air masses 2. Mediterranean.**—*Author's abstract.*

11.10–305 551.515.8:551.557

Riehl, Herbert (*Chic. Univ.*) and Higgs, Ralph (*U. S. W. B., San Juan, Puerto Rico*), **Unrest in the upper stratosphere over the Caribbean Sea during Jan. 1960.** *Journal of Meteorology*, Boston, 17(5):555–561, Oct. **1960.** 10 figs., 4 refs. Also issued as: *U. S. Weather Bureau, National Hurricane Research Project Report, No. 37*, April **1960.** 10 p. 10 figs., ref. **DWB** (M15.2 U5845r)—Wind observations were taken at a network of stations around the Caribbean from 100,000 to 120,000 feet altitude in January 1960. After an initial period of strong but variable easterly winds a large disturbance emanated from the equatorial zone with structure similar to what is observed in the low troposphere during the hurricane season. The history of this equatorial shearline is described. *Subject Headings:* **1. Upper air wind observations 2. Frontal perturbations.**—*Author's abstract.* Ⓢ

RADIATION

See also: **Radiation emerging from planetary atmosphere** (Coulson et al.), 11.10–2; **Actinometry, Polish expedition to Vietnam** (Paszyński), 11.10–17; **Photoelectrons from solar ultraviolet** (Hinteregger et al.), 11.10–43; **Surface finish of satellites** (Naumann), 11.10–45; **Solar batteries** (Daniel), 11.10–52; **Solar cells** (Heeger, Nisbet), 11.10–53; **Yearbook for 1959** (France. Bureau des Longitudes), 11.10–61; **Life and light** (Wald), 11.10–68; **Terrestrial particles from solar flares** (Ward), 11.10–79; **Solar corpuscular streams** (Mustel'), 11.10–85; **Radiometric observations of Venus** (Sinton, Strong), 11.10–104; **Cosmic Radiation, Sec. D 1,** p. 1605; **Comparison of pyrheliometric scales** (Dogniaux), 11.10–224; **Black-ball observations and radiation chart** (Gergen), 11.10–226; **Measurements and estimates of sky brightness** (Hulburt), 11.10–228; **Sunshine data for Austria** (Steinhauser), 11.10–229; **Earth radiations in the infrared** (Strong), 11.10–232; **Measurements with photoresistant cells in infrared** (Louisnard, Girard), 11.10–234; **Ventilation of radiation measuring equipment** (Schieldrup Paulsen), 11.10–235; **Circumsolar radiation and actinometer calibration** (Ross), 11.10–237; **Measurement of black-body radiation temperature** (Aagard), 11.10–238; **Interference filters for infrared** (Smiley), 11.10 239; **Vertical ozone distribution from Umkehr effect** (Dütsch), 11.10–264; **Infrared spectral emissivity, carbon dioxide and water vapor** (Tourin, Henry), 11.10–350; **Radiation climate of Austria** (Sauberer), 11.10–377.

11.10–306 550.36:551.521

Schulze, Rudolf (*Met. Obs. Hamburg*), **Einige Messergebnisse zum Energieumsatz am Erdboden.** [Some results of measurements of the energy exchange at the ground.] *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. B*, Vienna, 9(2):254–271, **1958.** 11 figs., 5 tables, 7 refs., 2 eqs. German, English and French summaries, p. 254–255. **DWB, DLC** – Series of measurements for the energy exchange at the surface are collected, separately for the energy gain by short-wave radiation, the energy loss by long-wave radiation and the energy consumption in the direction of ground, air and by evaporation; daily totals for a horizontal surface are considered. A comparison of the actually measured and the theoretically expected daily totals of short-wave radiation is made for the different geographical latitudes. For long-wave radiation some results of measurements obtained at Hamburg are referred to. For the energy consumption spent on the heating of the ground and the air and on evaporation the values obtained at the Quickborn observatory are discussed and compared with the results of the radiation measurements. *Subject Headings:* **1. Radiation budget 2. Energy balance of earth.**—*Author's abstract.*

11.10–307 551.521.1:551.509.9:621.47

Schüepp, Walter (*Service Mét. Bur. du Rayonnement, Léopoldville*), **Meteorologische Gesichtspunkte zur technischen Auswertung der Sonnenenergie.** [Meteorological viewpoint on the technological utilization of solar energy.] *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. B*, Vienna, 9(2):272–291, **1958.** 7 figs., 4 tables, 19 refs., 10 eqs. German, English and French summaries, p. 272–273. **DWB, DLC**—The intensity of the solar energy perpendicular to the solar beam at the limit of the earth's atmosphere is 1385 Watt/m². The

incoming radiation falling on a horizontal surface is studied for the climate of Belgian Congo with regard to the possibilities of its application for different purposes. Attention must be paid to the loss of heat by heat radiation of the receiving surface; this loss does not allow working at high temperatures with a black receiver. There exist materials (Cr and Ti on the plate surface for instance, or Al-SiO in thin layers on the glass plate surface facing the black plate) which have a much smaller heat radiation than a black surface and allow the flat plate receiver to work at higher temperatures (373°K for instance) even for low intensity of incoming radiation. In middle latitudes inclined or vertical surfaces facing south receive more radiation than a horizontal one, especially in winter; formulas are developed for estimating radiation income for such surfaces. Besides, possible efficiency for mechanical energy is calculated. *Subject Headings:* **1. Solar energy availability 2. Solar collectors.** *-Author's abstract.*

11.10–308 551.521.1:621.47

Schüepp, Walter, **L'utilisation de l'énergie solaire, aspects météorologiques.** [Use of solar energy: its meteorological aspects.] *Schweizerische Naturforschende Gesellschaft, Geneva, Verhandlungen*, 137:70–71, **1957. DLC** (Q67.S4)—Flat and stationary receivers for solar energy are investigated. The following factors are enumerated as against utilization on a large scale: 1) daily variations of output; 2) seasonal variations except in equatorial regions; 3) cloudiness except in desert regions; 4) thermal isolation of containers. It seems impossible to reach higher temperatures by a black surface. CARNOT'S thermodynamic process permits an output of 1% for the black plate with 30°C of the cold part of the apparatus, 4% for chrome, 9% for titanium and 16% for a special composition of thin sheets, valid for Stanleyville. The measurements of radiation during the Geophysical Year permit a more detailed study and continued computation by relatively simple formulas of the problem which would be the most favorable orientation and form of a receiver for a given place. *Subject Headings:* **1. Solar energy utilization 2. Solar collectors.**—*O.T.*

11.10–309 551.521.11

*Rhodesia and Nyasaland. Meteorological Service, **Mean sunshine duration and solar radiation at the upper limit of the atmosphere.** Its *Climate Information Sheet*, No. 14, Nov. **1959.** 2 p. entirely tables. **DWB**—Tables giving the total daily solar radiation at the upper limit of the atmosphere in cals/cm²/day and daily sunshine duration in hours for each month of the year and for each degree of latitude from 10°S to 30°S are presented. *Subject Headings:* **1. Sunshine duration data 2. Solar radiation data.**—*I.L.D.* ®

11.10–310 551.521.11/12(729.87)

Smith, G. W. (*Imperial College of Tropical Agric., Trinidad*), **Solar radiation and the duration of sunshine in Trinidad, West Indies.** *Royal Meteorological Society, Quarterly Journal*, 85(366):421–423, Oct. **1959.** fig., 7 refs., 6 eqs. [**Correction**] *Ibid.*, 86(369):415, July **1960.** ref., 3 eqs. **DWB, DLC**—Records of daily solar radiation energy extending over a period of one year have been compared with readings of sunlight duration obtained with a Campbell-Stokes recorder. Energy records were made with a bimetallic actinograph. The regression equation obtained for the daily values in Trinidad, West Indies was $R = R_A\ (0.20 + 0.59\ n/N)$, with a correlation coefficient of 0.91, where R = radiation actually received. R_A = Angot's theoretical amount of radiation which would reach the earth's surface in the absence of an atmosphere. These values are given by LIST (1951). n = actual duration of sunlight and N = theoretical maximum duration of sunlight. *Subject Headings:* **1. Solar radiation data 2. Sunshine duration data 3. Trinidad, West Indies.**—*Author's abstract.*

11.10–311 551.521.13

Wegener, Kurt (*Inst. für Met. und Geophysik der Univ. Graz*), **Die Kernfragen der Sonnenstrahlung in gedrängter Darstellung.** [The basic problems of solar radiation in condensed presentation.] *Geofisica Pura e Applicata*, Milan, 43:278–284, May/Aug. **1959.** 2 figs., 6 refs. **DWB, DLC**—General remarks on 1) electromagnetics and 2) heat or black radiation originating in the sun as they reach the earth. Auroral radiation is considered electrical along with lightning (most often produced at 0°C in atmosphere). Most of the text concerns the history of the development of the black-body radiation laws, and of the solar constant.

A graph shows a series of radiation measurements in ly/min made at LaQuiaca, Argentina (3400 m) at different air masses (solar angles 0° to 80°) from 25 to 1, giving constant = 2.9 − 0.6 = 2.3 ly/min. *Subject Headings:* **1. Blackbody radiation 2. Solar constant.**—*M.R.* ⑤

11.10–312 551.521.14:633

Monteith, J. L. (*Rothamsted Experimental Station, Harpenden, Herts*), **The reflection of short-wave radiation by vegetation.** *Royal Meteorological Society, Quarterly Journal,* 85(366): 386–392, Oct. **1959.** 3 figs., 17 refs. **DWB, DLC**—The fraction of short-wave radiation reflected from agricultural crops was measured from May till September 1958 using two portable solarimetric thermopiles. Maximum reflection coefficients from grass, lucerne, potatoes, sugar beet, and spring wheat were between 0.25 and 0.27. Lower values found in the early stages of crop development, and for spring wheat even at maturity, can be correlated with low leaf areas and mutual shading of the leaves, also reduced reflection. Data by BILLINGS and MORRIS (1951) have been used to compute total reflection coefficients for different types of vegetation including two desert species and to explain why these do not normally differ as much as the coefficients for the visible component. *Subject Heading:* **1. Albedo of vegetation.** —*Author's abstract.*

11.10–313 551.521.14(57)

Nekrasov, I. A., **Godovoĭ khod al'bedo vo vnutrennikh raĭonakh Chukotki.** [Yearly variations of albedo in the inland regions of Chukot Natl. District.] *Priroda,* Moscow, No. 12:94–95, Dec. **1958.** fig., table. **DLC**—The author analyzes one year of albedo observations (Sept. 1957–Aug. 1958) carried out in the interior of Chukot Natl. District on one of the large islands of the Anadyr' River about 2 km from Ust'-Belaya (65°29′N, 179°19′E). Observations were made daily at 1300 hours, mean local time, with an albedometer situated 1.5 m above the ground. A graph giving the annual variation of albedo and a table of monthly mean, minimum and maximum values of albedo are presented. The year is characterized by two periods: a summer period of about 4 months in which the variation of albedo is approximately 15% (7 to 22%) and a winter period of about 8 months in which the variation of albedo is about 30% (70 to 99%). The albedo of snow is more variable in comparison with that of tundra. The annual variation of albedo and the factors influencing it are discussed. *Subject Headings:* **1. Annual albedo variations 2. Chukot Natl. District, Kamchatka.**—*I.L.D.*

11.10–314 551.521.18

†Bennett, H. E.; Bennett, Jean M. (*Michelson Lab., U. S. Naval Ord. Test Station, China Lake, Cal.*), and Nagel, Max R. (*Air Force Camb. Res. Center*), **Distribution of infrared radiance over a clear sky.** *Optical Society of America, N. Y., Journal,* 50(2):100–106, Feb. **1960.** 7 figs., 22 refs., 7 eqs. **DWB, DLC**—Series of measurements of the distribution of radiance over a clear sky made from locations at approximately 1000, 6000, and 14,000 ft elevation are reported. A theoretical relation is shown to correctly predict the observed variation in radiance with elevation angle in the 2–40μ wavelength region, where radiation from the sky is mainly due to thermal emission by the atmosphere. In the 0.6–2μ region where the radiation is mainly scattered sunlight the distribution is related to that which was observed simultaneously in the visible but forward scattering is relatively more important in the near infrared and the relative intensities in the two regions are not constant. *Subject Headings:* **1. Infrared radiation studies 2. Solar radiation on clear days.**—*Authors' abstract.*

11.10–315 551.521.3:551.593.7

Coulson, K. L. (*Met. Dept. Univ. of Calif., Los Angeles*), **Characteristics of the radiation emerging from the top of a Rayleigh atmosphere, Pt. 1, Intensity and polarization.** *Planetary and Space Science, N. Y.,* 1(4):265–276, Sept. **1959.** 13 figs., 14 refs., 10 eqs. **Pt. 2, Total upward flux and albedo,** p. 277–284. 3 figs., 3 tables, 15 refs., 9 eqs. **DWB, DLC**—S. CHANDRASEKHAR'S solution of the equation of radiative transfer in a medium scattering according to Rayleigh's law has been used for an extensive series of computations of the scattered and diffusely reflected radiation directed outward from the top of a plane stratified model of the atmosphere. The results are discussed in two parts, the first of which deals with the intensity,

degree of polarization, plane of polarization and the neutral points of the scattered and diffusely reflected radiation. Part II is a discussion of the upward flux, integrated over the hemisphere, as a function of wavelength of the incident radiation, and of the albedo of the atmospheric model for an energy distribution of the incident light similar to that of the extra-terrestrial solar spectrum. The results are compared with similar quantities for the diffusely scattered radiation from the sunlit sky. *Subject Headings:* **1. Solar radiation intensities 2. Polarization of sky radiation 3. Atmospheric radiation upward flux 4. Albedo of earth's atmosphere.**—*Author's abstract.* Ⓢ

11.10–316 551.521.3

Deirmendjian, D. (*Rand Corp., Santa Monica, U. S. A.*), **The role of water particles in the atmospheric transmission of infra-red radiation.** *Royal Meteorological Society, Quarterly Journal*, 85(366):404–411, Oct. **1959.** 4 figs., table, 19 refs., 11 eqs. **DWB, DLC**—The attenuation of infra-red radiation by scattering on atmospheric haze particles, in the form of water droplets, is discussed in some detail. The spectrum is divided into two regions, the near infra-red to $\lambda 2.25\mu$, where the refractive index of water may be assumed constant and real, and the region 2.25 to 12μ, where the index is complex and varies with the wavelength. This paper is concerned with the first region. It is shown that certain haze models, involving a continuous drop-size distribution and previously used in explaining the attenuation of visible wavelengths and the aureole around the sun, adequately explain the window transmission measured by GEBBIE and co-authors (1951) along a horizontal path. The observed optical thickness of the whole atmosphere with respect to near infra-red sunlight is also explained by means of these models. The infra-red attenuation spectrum appears as a logical extension of the visible one and represents the continuous background upon which gas line and wing absorptions must be superposed. The magnitude of the latter can thus be assessed with more confidence. *Subject Headings:* **1. Atmospheric transmission 2. Infrared transmission through haze.**—*Author's abstract.*

11.10–317 551.521.3:551.576

Möller, F., **Über die Absorption kurzwelliger Strahlung in Wolken.** [Absorption of shortwave radiation in clouds.] *Frankfurt a.M. Universität. Meteorologisch-Geophysikalisches Institut, Bericht*, No. 6:55–58, **1956.** 4 eq., 3 tables, 9 refs. **DWB**—The absorption of short wave radiation (0.3–3.0μ) within a stratiform cloud is expressed by the equation $\Delta J = J_0 - J_0 A - J_0 T + J_0 T R_0$; where J_0 = incoming global radiation from above, A = upward reflected part of this radiation (Albedo), T = transmitted part of the radiation and R_0 = reflectivity of the ground and of the atmospheric layer between it and the cloud. To determine the absorption theoretically scattering through A and T must be computed. The solution of the radiation flux equation shows that the diffuse radiation penetrating a cloud is proportional to $e^{-\delta \alpha \chi}$ where $\delta = \sqrt{\gamma(1-\alpha+\beta)} < 1$. The determination of precise values of α, β and γ is discussed with special reference to the work of BULLRICH and NEIBURGER. Calculations of δ, α, β and γ for various assumptions of R_0 and A_α are presented and compared with those of NEIBURGER. *Subject Headings:* **1. Absorption by clouds 2. Short wave radiation.**—*I.L.D.*

11.10–318 551.521.3:546.264

Plass, Gilbert N. and Stull, V. Robert, **Theoretical study of high temperature emissivities and atmospheric transmission.** Ford Motor Company. Aeronutronic Div., Contract AF 19(604)-2166, Final Report (Pub. U-784), Jan. 30, **1960.** 81 p. 19 tables, 11 refs., 28 eqs. **DWB** (535.84P715th)—A number of different topics have been investigated which are connected with the determination of the high temperature spectral emissivity of molecules and solid particles and with the transmission of infrared radiation through the atmosphere. Basic to all of these calculations was the development of new mathematical models to represent the absorption of an infrared band. These models materially reduce the amount of computation involved without sacrificing accuracy. They were used to calculate the spectral emissivity of carbon dioxide from 1800 to 2500 cm^{-1} and of hydrogen chloride from 1000 to 3400 cm^{-1}. In both cases the calculations were valid up to 2400°K. The spectral emissivity of spherical carbon particles was also calculated up to 2400°K from the Mie scattering theory. Finally, new and more accurate calculations have been made of the atmospheric absorption of infrared

radiation in the region of most of the important bands. *Subject Headings:* **1. Atmospheric transmission 2. Infrared absorption.**—*Authors' abstract.* Ⓢ

11.10–319 551.510.535:551.594.12:551.521.67

Cole, K. D. (*Antarctic Div., Dept. of External Affairs, Melbourne*), **Low-energy corpuscular radiation at high altitudes.** *Nature*, London, 183(4664):738, March 14, **1959.** fig., 6 refs., eqs. **DWB** –A brief theoretical explanation, supporting the acceleration mechanism (Bohm and Gross), of the latitude dependent flux of electrons (50–90 keV.) at 100 km is presented. *Subject Headings:* **1. Corpuscular radiation 2. Ionospheric electron density distribution.** —*W.N.* Ⓢ

11.10–320 551.521.67:551.513

Macdonald, Norman J. and Roberts, Walter Orr (*both, High Alt. Obs., Univ. Colorado, Boulder, Col.*), **Further evidence of a solar corpuscular influence on large-scale circulation at 300 Mb.** *Journal of Geophysical Research*, Wash., D. C., 65(2):529–534, Feb. **1960.** 2 figs., 3 tables, 12 refs. **DLC**—Statistical evidence from three successive winter half-years strongly indicated that, when the earth is bombarded by unusually intense solar corpuscular emission, certain troughs in the 300-mb circulation are subsequently amplified. The troughs so affected enter or are formed in the Gulf of Alaska-Aleutian Islands area on the second, third, or fourth day after the start of the corpuscular increases. The trough amplifications maximize a variable number of days later, which may explain why the result was not apparent to earlier workers. The result has been found independently, at about the same level of significance, in the data for each of the three winters treated separately. For the data of three half-years grouped together the probability of such a strong chance association is less than 10^{-6}. *Subject Headings:* **1. Corpuscular radiation 2. Solar effects on general circulation.**—*Authors' abstract.* Ⓢ

TEMPERATURE

See also: **Thermal field of Arctic stratosphere** (McClain), 11.10 19; **Forecasting max. temp. in clear mountain weather** (Drimmel), 11.10–253; **Temperature as a function of altitude** (U. S. Army Ballistic Missile Agency), 11.10–256; **Constitution of upper atmosphere** (Nicolet), 11.10–262; **Diurnal temp. var. in mesosphere** (Wiebrock), 11.10–269; **Field of flow and temperature over Mediterranean** (Bleeker), 11.10 281; **Surface stress and heat flux from profile data** (Priestley), 11.10–284; **Pressure and temp. in turbulent flow** (Panchev), 11.10–330; **Temp. distribution and jet stream** (Saucier), 11.10–344; **Temp. difference mountain-free atmosphere** (Podol'skiĭ), 11.10–380.

11.10–321 551.524.31(261)

*Rosenthal, Stanley L. (*Florida State Univ.*), **The interdiurnal variability of surface-air temperature over the North Atlantic Ocean.** *Journal of Meteorology*, Boston, 17(1):1–7, Feb. **1960.** fig., 17 tables, 6 refs. **DWB, DLC**—This paper gives the results of an investigation of the interdiurnal variability of surface-air temperature at 9 of the North Atlantic Ocean Vessel Stations. Computations were performed for each month of the year over a four-year study period. Several aspects of the computational results are discussed in relation to the analogous statistics at land stations. *Subject Headings:* **1. Interdiurnal temperature variations 2. Temperature over oceans 3. North Atlantic Ocean.**—*Author's abstract.*

11.10–322 551.524.31(261):519.24

*Rosenthal, Stanley L. (*Florida State Univ.*), **The aperiodic diurnal range of temperature over the North Atlantic Ocean.** *Journal of Meteorology*, Boston, 17(1):78–83, Feb. **1960.** 3 figs., 8 tables, 9 refs. **DWB, DLC**—Frequency distributions of aperiodic diurnal ranges of temperatures at 9 of the North Atlantic Ocean Vessel Stations are examined. It is found that the means, dispersions, and asymmetries of these distributions are largest in winter and smallest in summer. It is also found that the aperiodic diurnal range exceeds the periodic diurnal range on virtually all winter days and on the great majority of summer days. *Subject Headings:* **1. Diurnal temperature variations 2. Temperature over oceans 3. North Atlantic Ocean.**—*Author's abstract.*

11.10–323 551.524.4:551.524.72(498)

Şorodoc, C., **Cîteva consideraiţi asupra inversiunilor şi isotermiilor de temperatură înregistrate în atmosfera liberă deasupra oraşului Bucureşti între anii 1952 şi 1956.** [Some considerations on temperature inversions and isotherms recorded in the free atmosphere over Bucharest during 1952–1956.] *Meteorologia, Hidrologia şi Gospodărirea Apelor*, Bucharest, 3(4):7–10, **1958.** 6 tables. Russian, French and English summaries, p. 75–79. **DWB**—By studying the temperature inversions and isotherms which have been revealed by the aerological soundings made in Bucharest in the nights of the period 1952–1956, the following relation was found with the time evolution in the next 24 hours in the different sectors of anticyclones. 1) When in the inversion stratum an increase with altitude of the relative and specific humidity is recorded, precipitation is produced and when both values decrease, in most of the cases weather is clear. 2) When in the inversion stratum the relative moisture decreases and the specific one increases with altitude, in 75% of the cases weak precipitation is recorded and in the rest considerable cloudiness (8–10/10) occurs. *Subject Headings:* **1. Temperature inversions 2. Temperature correlations.**—*Author's abstract.*

11.10–324 551.524.7:551.510.535:621.396.8

Dowden, R. L. (*Ionospheric Prediction Service, Hobart, Tasmania*), **Ionospheric thermal radiation at radio-frequencies in the auroral zone.** *Journal of Atmospheric and Terrestrial Physics*, N. Y., 18(1):8–19, April **1960.** 6 figs., 2 tables, 11 refs. **DLC**—Measurements of the temperature of the ionospheric D-region in the auroral zone from observations of 2 Mc/s radio noise are described and compared with measurements similarly made in the temperate region. The temperatures of the undisturbed and disturbed ionospheres at the two latitudes are found to be essentially similar, but the disturbing influence in the auroral zone is probably corpuscular rather than ultra-violet radiation. *Subject Headings:* **1. Ionospheric temperatures 2. D region 3. Radio noise from ionosphere.**—*Author's abstract.* Ⓢ

PRESSURE AND WIND

PRESSURE

See also: **Diurnal var. of pressure in Mediterranean area** (Bleeker), 11.10–274; **Nonlinear differential equations of atm. tides** (Pekeris, Alterman), 11.10–279; **Pressure oscillation on heated mountain island** (Pyle), 11.10–280; **Surface stress and geostrophic drag in surface layer** (Lettau), 11.10 282; **Persistence of mid-tropospheric circulations** (Namias), 11.10–292; **Pressure and temp. in turbulent flow** (Panchev), 11.10–330; **Mountain waves over S. Norway** (Gotaas), 11.10–347, 11.10–348.

11.10–325 551.541:551.557:629.135.15

Gillopé, G., **Der Aufbau der langen Welle in der Atmosphäre.** [Long wave structure in the atmosphere.] *Schweizer Aero-Revue*, Zurich, 35(4):232–234, April **1960.** 5 figs. Text in German and French. **DLC**—This work is based on some years of personal studies and observations during flights (sailplane) and on the ground. The author gives a very clear schematic account of the formation of a wave and of the displacement of an undulation. When taking as a basis surface observations and recordings during flight, one notes that the temperature undergoes a well marked warming at a certain altitude (characteristic inversion). There is a rotation and a reinforcement of the wind aloft and in the lower layers as compared with the valley axis (Venturi effect), and a certain helicoidal which finds its origin and support in the inversion. These considerations have enabled the author to represent the development and structure of the wave on a diagram. *Subject Headings:* **1. Atmospheric wave structure 2. Long waves 3. Temperature inversions 4. Sailplane observations.**—*A. V.*

11.10–326 551.542:551.552

Shaĭdman, V. A., **Vliianie nestatsionarnosti polia davleniia na raspredelenie vetra v pogranichnom sloe.** [The influence of a non-stationary pressure field on wind distribution in the boundary layer.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, 77:65–71, **1958.** 4 figs., ref., numerous eqs. **DWB, DLC**—An attempt is made to derive correct formulae

for nonstationary pressure fields for use in practice. It is assumed that $u=\bar{u}(z)+u_1(t,z)$; $v=\bar{v}(z)+v_1(t,z)$; $ug=\bar{u}g+u'g(t)$; $vg=\bar{v}g+v'g(t)$ where $\bar{u}$ and $\bar{v}$ are components of velocity during stationary field pressure when $\partial\bar{u}/\partial t=\partial\bar{v}/\partial t=0$; $u_1(t,z)$ and $v_1(t,z)$ are corrections to velocity components during stationary field pressure arising because of its not being stationary. Analogous to the geostrophic wind u, v, u_1, v_1 = velocities of the actual and geostrophic wind during a non-stationary field. The problem involves finding u_1 and v_1. Proceeding from the equation of motion the author illustrates the derivation of equations for u_1 and v_1, analyzes the physical meaning of the equations and presents nomograms for determining the values of u_1 and v_1. *Subject Headings:* **1. Pressure-wind relationships 2. Wind calculations.**—*I.L.D.*

11.10–327 551.542:550.386.6

Shapiro, Ralph (*G. R. D. AF Cambridge Res. Center*), **A comparison of the response of the North American and European surface pressure distributions to large geomagnetic disturbances.** *Journal of Meteorology*, Boston, 16(5):569–572, Oct. **1959.** 6 figs., 2 tables, 3 refs. Also [**Comments**] by Munk, Walter H. (*Scripps Inst. of Oceanog.*) and [**Reply**] by Shapiro, *Ibid.*, 17(1):92–94, Feb. **1960.** fig., table, 2 refs., 5 eqs. **DWB, DLC**—The persistence of the three-day mean surface pressure distribution in a mid-latitude region centered on the Greenwich meridian is examined in connection with large increases in geomagnetic activity and is compared with an earlier study concerned with the same parameters over a different region. The reactions of certain individual features of the pressure distributions of the two regions are also investigated. *Subject Headings:* **1. Surface pressures 2. Pressure distribution 3. Geomagnetic correlation with pressure.**—*Author's abstract.* Ⓢ

11.10–328 551.543:551.511

Mariani, F. (*Inst. Nazionale di Geofisica, Rome*), **On the general theory of thermal and gravitational excitation of atmospheric oscillations.** *Annali di Geofisica*, Rome, 12(4):497–514, Oct./Dec. **1959.** 4 figs., 7 refs., 36 eqs. English and Italian summaries p. 513–514. **DLC** — In this paper the author reconsiders the general theory of atmospheric tidal oscillations, assuming the correct height variation of the Earth's radius vector R and of the acceleration of gravity g. The fundamental tidal equation is solved separately for the case of purely gravitational and purely thermal oscillations. In the condition of resonance the pressure oscillation p is substantially identical in the two cases; with respect to the classical case of constant R and g the resonance period in the present generalized case is some minutes greater than the period calculated by WILKES and the resonance spectrum, as a whole, exhibits a slight shift. The amplitude of p is approximately 1.5 times smaller than in the case of WILKES; an important feature is that the height of the nodal point of the pressure oscillation p, i.e. the height at which the sign of p is changed, is considerably greater in the present case (~80 km) than in the WILKES case (~35 km). *Subject Headings:* **1. Atmospheric oscillations 2. Thermodynamics of the atmosphere.**—*Author's abstract.* Ⓢ

TURBULENCE

See also **Explanation of clear-air turbulence** (Arakawa), 11.10–23; **New approaches to soaring** (Raspet), 11.10–25; **Dosages for point and cubical volume sources** (Greenfield), 11.10–60; **Turbulence at meteor heights** (Hines), 11.10–108; **Booker's theory of meteoric reflection** (Manning, Eshleman), 11.10–112; **Turbulence in shear flow** (Monin), 11.10–276; **Surface stress and drag coefficients in surface layer** (Lettau), 11.10–282; **One-dimensional turbulence spectra in lowest 100 m** (Panofsky, Deland), 11.10–283; **Rise of bent-over hot plumes** (Scorer), 11.10–285; **Diffusion of particles in turbulent flow** (Tchen), 11.10–286; **Deacon wind profile** (Shiotani), 11.10–336.

11.10–329 551.511:551.551

†Frenkiel, F. N. (*Johns Hopkins Univ., Applied Physics Lab.*), **Turbulent diffusion: mean concentration distribution in a flow field of homogeneous turbulence.** *Advances in Applied Mechanics*, N. Y., Vol. 3:61–107, **1953.** 25 figs., 32 refs., numerous eqs. **DLC** (TA350.A4)—One important application of statistical turbulence theory, namely turbulent diffusion, is reviewed in a systematic manner, covering basic theory of turbulence and fluid motion, diffusion and dispersion theory (molecular, Brownian and turbulent), statistical description of a tur-

bulent field (averaging mean and turbulent velocities intensity, Eulerian correlation coefficients, homogeneous, isotropic and stationary turbulence, spectra, decay, local esotrophy, Lagrangian correlation coefficient); fundamental equations of isotropic and turbulent diffusion ignoring decay, mean concentration distribution from point source and a line source, respectively for instantaneous-continuous emission, at small and large distances and, finally, the differential equation and coefficients for nonisotropic turbulence. *Subject Headings:* **1. Turbulent diffusion 2. Statistical theory of turbulence.**—*M.R.*

11.10–330 551.524:551.541:551.551

Panchev, St., **Vzaimnaia korreliatsiia davleniia i temperatury v turbulentnom potoke.** [Mutual correlation of pressure and temperature in turbulent flow.] *Bulgarska Akademiia na Naukite, Sofia, Doklady*, 12(2):117–120, March/April **1959.** 6 refs., 21 eqs. French summary p. 120. **DWB**—A study of the mutual correlation of the pressure and temperature in homogeneous, isotropic and stationary flow has been conducted. The mutual correlation is found to satisfy the equation

$$x\left(\frac{\partial^2 BPT}{\partial r^2}+\frac{2}{r}\frac{\partial BPT}{\partial r}\right)=\pm\frac{\partial BPT}{\partial t}$$

where BPT is the mutual correlation coefficient. This shows the existence of an invariance in agreement with Loitzianski who derived $\int_0^\alpha r^2 BPT$ as a constant. *Subject Headings:* **1. Pressure-temperature correlations 2. Turbulent flow.**—*N.N.*

11.10–331 551.551:551.554

Tick, Leo J., **Analysis of wind structure, Phase 3, Mathematical analysis of turbulent structure.** N. Y. Univ. College of Engineering. Research Div. Dept. of Mathematics, Contract DA-36-039-Sc-78091, Interim Final [Report], June 1–Oct. 31, **1959.** 13 p. fig., 2 refs., 14 eqs. **DWB** (M(051) N532an)—An example of the conditioned isotropic model is computed and curves of the vertical velocity spectra as a function of height are given. The curves are in general agreement with some currently available measurements. The mean wind profile of this specific example is also given. Some discussion of rocket response functions is included. *Subject Headings:* **1. Isotropic turbulence 2. Vertical wind velocity distribution 3. Turbulence effects on rockets.**—*Author's abstract.*

WIND—WIND VARIATIONS

See also: **Flow and temperature over Mediterranean** (Bleeker), 11.10–281; **Influence of pressure field on wind distrib. in boundary layer** (Shaĭdman), 11.10–326.

11.10–332 551.501.75:551.553.11

Fisher, Edwin L., **Study of low level wind field.** New York. Univ. College of Engineering. Research Div., Contract DA-36-039-sc-78091, Quarterly Progress Report, No. 1, June 15–Oct. 15, **1958.** 9 p. 2 figs., 2 refs. **DWB** (M53.11.N532se)—A description of the location, the types of observations taken and the instruments used for the first set of sea breeze observations at Block Island is given. The study was made during August 1958 and the data that were collected during the 125 pilot balloon runs and 50 soundings have been analyzed and are presented as a preliminary report. *Subject Headings:* **1. Low level wind measurement techniques 2. Sea breezes 3. Block Island, R. I.**—*N.N.*

11.10–333 551.511:551.553.11:632.187(795)

Lowry, William P., **Energy budgets of several environments under sea-breeze advection in western Oregon.** *Journal of Meteorology*, Boston, 16(3):299–311, June **1959.** 13 figs., 8 tables, 12 refs., 13 eqs. **DWB, DLC**—In order to provide basic information on micrometeorology as related to forest-fire weather and forest regeneration, a series of measurements was made in the central Oregon Coast Range. Net radiation, flux, soil heat storage, and evaporation were calculated from observations, while turbulent flux was considered the residual of

these three. Based on published energy-budget data from situations in which advection was considered absent, an estimate was made of what the turbulent flux would have been at these Oregon stations in the absence of the sea-breeze. Differences between these hypothetical values and the observed values are termed the "total advection effect" and are separated into vertical and horizontal components. *Subject Headings:* **1. Advection of heat 2. Sea breeze circulation 3. Fire weather studies 4. Oregon, U. S.**—*Author's abstract.*

11.10–334 551.553.11:551.555.4(497.1)

Makjanič, Berislav, **Die wechselseitige Beeinflussung von Seewind und Bora.** [Interrelationship between sea breeze and bora.] *Germany. Deutscher Wetterdienst, Berichte*, 8(54):218–220, **1959.** 5 figs. German and English summaries p. 218. **DWB, DLC**—In the investigation of the sea breeze at Split, on the east coast of the Adriatic, it was found that during the year 1956 in 22% of the cases the sea-breeze occurred simultaneously with the upper flow directed from land to sea. The upper flow is defined as the average wind between 1600 and 3000 m. It was possible to obtain the wind profile of the "pure" sea-breeze by vector subtraction of the theoretically derived profile of the general wind from the actual wind profile for the days when general wind from land and sea-breeze were superposed. This sea breeze profile is in good accordance with the theoretical one. It was found at the same time that the Ekman spiral, although considered in a two layer model of the atmosphere, gave poor approximation of the actual bora profile. Therefore an empirical profile of the bora wind from five days of strong bora was derived. The accordance between theoretical and empirical profile of the "pure" sea-breeze was thus further improved. *Subject Headings:* **1. Sea breeze—bora relationships 2. Bora 3. Split, Yugoslavia.**—*Author's abstract.*

11.10–335 551.553.6:551.557.36(234.3)

Pristav, Janko, **Abweichungen des Windes auf den alpinen Beobachtungsstationen in Bezug auf die Strömung in der freien Atmosphäre.** [Wind deviations at the Alpine observation stations in relation to the current in the free atmosphere.] *Germany. Deutscher Wetterdienst, Berichte*, 8(54):241–243, **1959.** 2 figs., 2 tables. German, English and French summaries p. 241. **DWB, DLC**—A comparison shows great differences in speed and direction between the winds at various mountain weather stations and the winds in the free atmosphere. These differences largely depend on the shape of the orographic barrier. It is particularly important whether the flow on its passage over the barrier becomes turbulent or remains laminar. The difference between the winds at mountain weather stations and those in free atmosphere can be very well used for local weather forecasting. *Subject Headings:* **1. Wind deviation 2. Wind direction—speed relationships 3. Orographic effects on winds 4. Upper air wind 5. Alps.**—*Author's abstract.*

WIND PROFILES

See also: **Turbulence in shear flow with stability** (Monin), 11.10–276; **Wind profile in atm. surface layer** (Lettau), 11.10–282; **Surface stress and heat flux from profile data** (Priestley), 11.10–284; **Analysis of wind structure** (Tick), 11.10–331.

11.10–336 551.554:551.551:533.16

Shiotani, Masao (*Railway Technical Res. Inst., Tokyo*), **Discussion of [Ben Davidson and Morton L. Barad]: Some comments on the Deacon wind profile, Reply by Davidson and Barad.** *American Geophysical Union, Transactions*, 38(2):257–259, April **1957.** table, 3 refs., 2 eqs. **DWB, DLC**—An analysis is made of the micrometeorological data taken in 1953 at the Great Plains study by Johns Hopkins University (*see* 6.2–46, Feb. 1955, *Met. Abstr.*) which dealt with the determination of parameters in the Deacon profile wherein wind velocity and temperature data were used. SHIOTANI notes that the estimation of shear stress is too small under stable conditions and too large under lapse ones; and observations at lower levels are preferred. DAVIDSON and BARAD reply to the effect that the Deacon formula is not adequate for describing stability variations in the wind profile close to the ground. (For original article by Davidson and Barad, *see* 7.11–221, Nov. 1956, *Met. Abstr.*) *Subject Headings:* **1. Deacon wind profile 2. Wind shear.**—*N.N.*

11.10–337 551.554:551.482.2

*Wegner, Karl Otto, **Windprofilmessungen über Flussoberflächen bei schwachem Wind.** [Wind profile measurements over river surfaces during weak wind.] *Cologne. Universität. Meteorologisches Institut, [Veröffentlichungen]*, No. 3, **1956.** 58 p. 13 figs., tables, 12 refs., eqs. **DWB** (M(055) C718ve)—Existence of an impulse transport water-to-air was determined by measurements conducted on the Rhine river May 4, July 23, August 4, October 8 and 11, 1953, and May 25, June 21 and November 5, 1954. Method and instruments employed are described in some detail. The immediate air layer up to 100–150 cm above a river surface moves along with the warmer water current when the wind force is <4 m/sec. There is a distinct boundary (characterized by directional wind shift) above which the wind velocity is a linear function of the logarithm of the height. Computed exchange coefficients of movement show that the exchange above this boundary layer increases linearly with height neglecting directional wind shifting, otherwise the exchange coefficients depart from linearity conversely proportional to the force of the wind shift. *Subject Headings:* **1. Wind profiles over rivers 2. Energy exchange river-atmosphere.**—*W.N.*

11.10–338 551.554:551.555.1(263)

Gutnick, Murray (*GRD, AF Camb. Res. Center*), **Climatology of the trade-wind inversion in the Caribbean.** *American Meteorological Society, Bulletin*, 39(8):410–420, Aug. **1958.** 4 figs., 11 tables, 10 refs. **DWB, DLC**—A climatological analysis of the Caribbean trade wind inversion on the basis of radiosonde observations made twice daily (0300 and 1500 GCT) for a period of 3 years during January, April, July and October at six stations in the Caribbean. The seasonal, spatial and diurnal variations of the following parameters of the trade wind inversion were analyzed: frequency, topography (height), thickness (vertical extent), strength (temperature difference between the base and top of the inversion), moisture distribution through the inversion, and moisture content of the air above and below the inversion. The trade wind inversion occurs most frequently during winter and least frequently during summer or autumn, and the seasonal transition is not gradual and smooth. The diurnal variation in the frequency of the inversion is negligible. During winter the inversion frequency increases slightly from east to west; there is consistent north-south variation. In all other seasons there is no systematic meridional or zonal variation. The strength of the inversion, ΔT, for the Caribbean inversion is very small, and the seasonal trend of the strength resembles that of the frequency; ΔT shows no systematic diurnal variation and a very slight spatial variation. The height of the base of the inversion (Z_b) is greatest in summer. Year to year variations in the mean height of the inversion base are relatively largest but not extreme. There is no significant zonal variation in the height of the inversion at any time but during January and April it is somewhat higher in the south than in the north. The thickness of the inversion is the only parameter showing no consistent seasonal variation; its mean value does not change much from year to year; it does not possess a diurnal variation and it does not vary spatially, either zonally or meridionally in any season except summer. The moisture variation below the inversion as indicated by relative humidity and mixing ratio shows little seasonal change. Spatial and diurnal variation in both mixing ratio and relative humidity are negligible. The change of relative humidity and mixing ratio from the base to the top of the inversion decreases from warmer to colder weather; there is no significant spatial or diurnal variation. The moisture distribution from the top of the inversion to the 500 mb level shows a marked seasonal change. The mechanism for the increase in moisture above the inversion is explained by convection. *Subject Headings:* **1. Trade inversions over the Caribbean 2. Trade wind variations 3. Caribbean.**—*I.L.D*

SPECIAL WINDS

See also: **Aerological criteria for gliding** (Kaufmann), 11.10–24; **Sea breeze and bora** (Makjanič), 11.10–334; **Climatology of trade-wind inversion** (Gutnick), 11.10–338.

11.10–339 551.555.3:551.586:616

Reifferscheid, Hellmut, **Atmosphärische Zustände und Vorgänge bei Wetterphase 3 (Föhn) nach Ungeheuer.** [Atmospheric conditions and processes during weather phase 3

(Föhn wind) according to Ungeheuer.] *Germany. Deutscher Wetterdienst, Berichte*, 8(54):88–93, **1959.** 4 figs., table, 9 refs. **DWB, DLC**—Weather phase 3 of Ungeheuer's system of weather phase analysis is examined in detail with special reference to air flow conditions above the ground layer and the extent to which the biological action of föhn is brought about by processes in subsiding air, by subsiding air or by simultaneous meteorotropic processes. On the basis of weather phase analysis for 1954, 1955 and 1956 for Tölz, Munich and Augsburg the author established synoptic aerological characteristics and biotropic properties of weather phase 3. The appearance of weather phase 3 during cyclonic weather was associated with all cases in which winds with southerly components appeared in the lowest 2 km of the atmosphere. The winds aloft did not have to conform to this criterion; here the wind rotated with height on freshening to the right west to northwest. Such situations are characterized by the fact that in spite of less relative humidity (45% and 38%) at the surface, more than six tenths ci and cs clouds appear aloft. Synoptically this concerns the wide areas between fronts in which high pressure influences are simulated. True föhn days include all those days in which winds with southerly components appear in all levels above the station. Synoptically there are always the areas of eastward moving fronts. Biotropic influences are restricted to all those situations in which the wind field manifests southerly components also aloft during the passage of fronts. This is the case when the winds aloft from the SE rotates to the right during a föhn situation without blowing to the west. The biotropic stimuli diminish when weather phase 3 lasts more than 3 days. On the approach of a cold front, that is during the rotation of the wind aloft to the right, the biotropic influences intensify again. At the surface weather phase 3 is then followed by weather phase 4. Weather situations with weather phase 3 in the surface milieu but with westerly to northwesterly flow and cloudy areas aloft are not unfavorable biologically. *Subject Headings:* **1. Föhn weather 2. Biological effects of weather elements.**—*I.L.D.*

WIND EFFECTS

See also: **Highway planning Wr. Neustadt-Oberwart** (Friedrich), 11.10–54; **Low-level wind structure** (Hewson et al.), 11.10–233; **Rotation of dust devils** (Brooks), 11.10–297; **Meteorol. factors in desert of Iceland** (Hennell, Ashwell), 11.10–298.

11.10–340 551.509.322.7:551.556.4:551.510.721

†Haarländer, Hans, **Zum Problem der Verfrachtung radioaktiver Spurenstoffe in der Atmosphäre.** [The problem of the transport of radioactive trace elements in the atmosphere.] *Germany. Deutscher Wetterdienst, Berichte*, 8(55):1–32, **1959.** 34 figs., 8 tables, 41 refs., 114 eqs. **DWB, DLC**—The problem of the atmospheric transport of radioactive trace elements is treated as a purely meteorological problem. The fundamental kinematic concepts of stream lines and trajectories are represented vectorially and their differences are pointed out. The processes of movement and a fluid are described by the equations of EULER and LAGRANGE and an equation is derived for representing the geopotential of an air particle in the Lagrangian form. Two analytical models with relevant geostrophically approximated trajectories and a non-geostrophic baroclinic stream field are computed and compared with the corresponding geostrophically approximated and non-geostrophic trajectories. The non-geostrophic trajectories were calculated in the zero layer as defined by FAUST. The method of constructing trajectories by a graphical procedure taking into account spatial variable translation and developmental processes arising during pressure change is presented and tested in forecasting trajectories in the 500 mb level. The absolute topographies of a pressure surface were used for the graphic construction of the air trajectories. The wind vectors were determined by means of a gradient wind scale. The nonstationary pressure field is divided into a translation and a development part. The constructions taking into account the translation of the pressure configuration by itself and the developmental changes by themselves are carried out and the errors of the graphic constructions are evaluated. The mean vector error in case of forecast trajectories amounted to 24.5% of the length of the trajectories of the first approximation. The paths of the smoke particles of the Canadian forest fires in the summer of 1950, the transport of Sahara sand and the transport of atomic dust as indicated by recent studies are discussed. *Subject Headings:* **1. Trace elements in atmosphere 2. Transport of radioactive dust 3. Wind effects on radioactivity.**—*Author's abstract & I.L.D.*

11.10–341 551.556.8:551.465

Hansen, Walter (*Inst. Meereskunde, Univ. Hamburg*), **Wind und Massenverteilung als Ursache der Meeresströmungen.** [Wind and mass distribution as causes of ocean currents.] (In: Bolin, Bert, ed., **The atmosphere and the sea in motion.** N. Y., Rockefeller Institute Press, **1959.** p. 102–106. 2 figs., 5 refs., 7 eqs.) **DLC**—The relation between velocity and pressure as unknowns, and wind and mass distribution as known factors in the ocean is represented and special cases of the topography of the sea surface as a function of density distribution are treated. It is shown that a "null" or reference surface is not required by dynamic theory. Examples show these relations as well as the influence of the various parameters on the current and current velocity. *Subject Headings:* **1. Ocean current dynamics 2. Sea surface topography 3. Wind-mass distribution in sea.**—*Transl. of author's abstract.*—(*M.R.*)

UPPER AIR WINDS

See also: **Air motions at meteoric heights** (Manning), 11.10-109; **Motion of irregularities in ionosphere** (Tsuda), 11.10-160; **Mediterranean in relation to general circulation** (Sutcliffe), 11.10-288; **Front as circulation system** (Bleeker), 11.10-289; **Interhemispheric features of gen. circulation** (Rao), 11.10–291; **Fronts and jet stream** (Bleeker), 11.10-303; **Unrest over Caribbean Sea, Jan. 1960** (Riehl), 11.10–305; **Long wave structure** (Gillopé), 11.10–325; **Alpine flow in free atmosphere** (Pristav), 11.10–335.

11.10–342 550.38:551.557:551.510.535(98/99)

Maeda, Hiroshi (*Dept. of Earth Science, Yoshida College, Kyoto Univ.*), **Wind systems for the geomagnetic S_d field.** *Journal of Geomagnetism and Geoelectricity*, Tokyo, 9(2):119–121, **1957.** 4 figs., table, 6 refs. **DWB**—Data on the horizontal intensity of geomagnetic S_d variations at 62 stations all over the world for 1932–3 were used to determine the wind systems (both diurnal and semi-diurnal) which are shown on polar charts. The data mentioned above are used to calculate the total electric field by first calculating the conductivity and the geomagnetic intensity, then the dynamo equation is solved. Comparison with S_q winds obtained the same way shows that the S_d winds in the polar region are much stronger (200–400 m/sec). It is concluded that in the absence of exceptional conductivity in polar regions, these strong winds must exist. *Subject Headings:* **1. Ionospheric winds in polar regions 2. S_d wind systems 3. Geomagnetic-upper wind relationships.**—*M.R.* ©

11.10–343 551.557.36/5(73)

Landsberg, H. E. and Ratner, B. (*both, Office of Clim., U. S. W. B., Wash., D. C.*), **Note on frequency of high winds over the United States.** *Monthly Weather Review*, Wash., D. C., 87(5):185–187, May **1959.** 3 figs., 4 refs. **DWB, DLC**—A summary and analysis of winds of $\geqslant$100 mph (by punched card) from data for 1957 and 1958 for all 36 U. S. stations having GMD-1 or GMD-1A radar wind measuring equipment, shows for January a variation from $>70\%$ in the North Carolina area to $<25\%$ in the Columbia Basin; for July a variation from 0% south of 35° latitude to $>30\%$ in northern New York and Vermont; and from $>40\%$ in New England and $<15\%$ in California-Nevada for the year as a whole. The belt of January maximum just north of the Gulf Coast coincides with the average position of the jet stream in January (Namias and Clapp), and in July north of the Great Lakes and St. Lawrence lies just east of the jet stream maximum, and a secondary maximum just east of the Rockies may be dynamically caused. *Subject Headings:* **1. Strong wind frequencies 2. Jet stream climatology of U. S. 3. Upper air wind frequencies 4. United States.**—*M.R.*

11.10–344 551.557.5:551.524.72:551.557.2

Saucier, W. J., **A summary of wind distributions in the jet streams of the southeast United States investigated by Project Jet Stream.** (In: Saucier, W. J. et al., **Wind field near the tropopause.** Texas Agricultural & Mechanical College, Dept. of Oceanography and Meteorology, Contract AF 19(604)-1565, Final Report, Dec. **1958.** p. 6–57 (23 figs., 2 tables, 15 refs.) **DWB**—Jet stream intensity not only depends on latitude but also on wind and temperature distributions. The report discusses and analyzes the transverse perturbation patterns in the wind profiles and the turbulence of winds as observed during multi-level flights. The character-

istics of the jet streams are presented. Over 20 charts on winds, temperature, etc. are included. *Subject Headings:* **1. Jet stream winds 2. Upper air wind trajectories 3. Upper air temperature distribution 4. Project Jet Stream.**—*N.N.*

11.10–345 551.557.5

Taba, Hessam (*Internat. Met. Inst., Univ. Stockholm*), **The horizontal and vertical wind profiles of the subtropical and polar jet for Jan. 1–7, 1956 and the variation of the equivalent barotropic level.** *Tellus*, Stockholm, 11(4):441–451, Nov. **1959.** 14 figs., 2 tables, 6 refs., 3 eqs. **DLC**—All the available wind information over central, west and north Europe, the Atlantic Ocean, the United States and Canada has been studied for a period of seven days, Jan. 1–7, 1956, 0300 Z. The axis of the subtropical and the polar jets have been chosen as reference coordinates. Mean horizontal and vertical wind profiles have been computed at 100 km intervals from the axis of both jets and are discussed. Based on these profiles, the average wind and the equivalent barotropic level are computed. It is shown that the height of the equivalent barotropic level changes as the distance from the axis of the jet varies. The equivalent barotropic level is shown to have a maximum height of 432 mb at the axis of the subtropical jet and a minimum height of 560 at a distance of 1,000 km north of the polar jet. Finally, an average E.B.L. is computed and is shown to have a height of 505 mb. *Subject Headings:* **1. Jet stream winds 2. Wind profiles 3. Equivalent barotropic level.**—*Author's abstract.*

VERTICAL MOTION

See also: **Aerological criteria for gliding** (Kaufmann), 11.10–24; **New approaches to soaring** (Raspet), 11.10–25; **Influence of rotation on convection** (Starr), 11.10–273; **Disturbances in conditionally unstable atmosphere** (Lilly), 11.10–275; **Pressure oscillation on heated mountain island** (Pyle), 11.10–280.

11.10–346 551.558.2:551.501.75(265/6)

Rex, Daniel Ferrell (*U. S. Navy*), **Vertical atmospheric motions in the equatorial central Pacific.** *Geophysica*, Helsinki, 6(3/4):479–501, **1958.** 14 figs., 2 tables, 14 refs., 11 eqs. **DWB, DLC**—A kinematic method for calculating vertical wind-velocity components from the horizontal wind field in equatorial areas is described. The results obtained from a series of daily calculations, made during spring/summer 1956 in the Eniwetok/Bikini area, are presented and discussed. Individual vertical motion patterns are described. Mean vertical motions are computed and their significance in the mean equatorial meridional circulation is discussed. *Subject Headings:* **1. Vertical wind velocity calculations 2 Mean wind flow patterns 3. Equatorial circulation 4. Central Pacific.**—*Author's abstract.*

11.10–347 551.558.21:551.541

Gotaas, Yngvar, **An investigation of mountain waves over Southern Norway.** *Norske Videnskaps-Akademi i Oslo. Institutt for Vaer-og Klimaforskning, Report*, No. 5, **1956/1957.** 17 p. 21 figs., 2 tables, 6 refs. **DWB** (M(055) M863p)—Vertical velocities, amplitudes of computed streamlines, wave length, lapse rates surface-tropopause, and wind variation data obtained in 8 jet aircraft flights through lee waves over Norway are tabulated and charts and vertical sections showing synoptic situations during the flights are presented. Results are compared with similar data obtained over the Sierra Nevada mountains. The observations over Norway appear to confirm findings of E. Palm (1955) concerning the occurrence and size of mountain waves. *Subject Headings:* **1. Mountain waves 2. Lee waves 3. Southern Norway.**—*G.T.*

11.10–348 551.558.21:551.541

Gotaas, Y., **Mountain waves over Southern Norway, July 26, 1956.** *Meteorological Magazine*, London, 87(1032):168–172, June **1958.** 3 figs., eqs. **DWB, DLC**—The purpose was to check whether characteristic features of mountain waves may be determined from flights. A Sabre jet aircraft flew with stabilized instruments at 25,000 ft between 1100 and 1200 GMT. The path at 380 mb is shown plotted at the 300 mb chart at 1500 GMT above Sola Airfield and the synoptic situation is given. The vertical cross section of mountains

with the resultant flight profile of wave motion is subjected to a brief theoretical discussion. *Subject Headings:* **1. Mountain waves 2. Lee waves 3. Southern Norway.**—*W.N.*

11.10–349 551.558.21:532.59

Gutman, L. N., **Primenenie metoda dlinnykh voln v zadache obtekaniia gor.** [Application of the method of long waves to the problem of flow over mountains.] *Akademiia Nauk SSSR. Doklady*, 115(3):497–500, July **1957.** 2 figs., 5 refs., 16 eqs. **DWB**—The problem of stationary nonlinear flow over a mountain is treated mathematically in reference to a system of a horizontal and a vertical coordinate, under the assumption of a horizontal component much larger than the vertical one, i.e. considering it as a long-wave problem. From the equations obtained two flow patterns are constructed showing streamlines for mountains 1) above and 2) below a critical height. *Subject Headings:* **1. Mountain waves 2. Long waves.** —*G.T.*

AQUEOUS VAPOR, HYDROMETEORS AND HYDROLOGY

HUMIDITY

See also: **Vapor pressure measurements at high temperatures** (Farkel), 11.10–240; **Hum. difference mountain-free atmosphere** (Podol'skiĭ), 11.10–380; **Effects of humidity on heat exchange of men** (Iampietro et al.), 11.10–381.

11.10–350 546.264:551.571:551.521.18

†Tourin, Richard H. and Henry, Paul M., **Infrared spectral emissivities and internal energy distributions of carbon dioxide and water vapor at high temperatures.** Warner & Swasey Co., New York, Contract AF 19(604)-2223, Final Report, Dec. **1959.** 98 p. 88 figs. (incl. photo), 6 tables, 30 refs., numerous eqs. **DWB**—Infrared spectral emissivities of hot carbon dioxide and water vapor have been determined by measurement of the infrared absorption spectra of gas samples heated under controlled conditions. The measurements are described and are discussed in relation to molecular energy distributions, theoretically calculated emissivities, and flame radiation. *Subject Headings:* **1. Carbon dioxide spectrum 2. Infrared absorption spectrum 3. Water vapor absorption spectra.**—*Authors' abstract.*

11.10–351 551.571.2(78,79) 551.501.771

Sellers, William D., **Distribution of relative humidity and dew points in the Southwestern United States.** *Arizona. Univ. Institute of Atmospheric Physics, Scientific Report* No. 13, Feb. 1, **1960.** 49 p. 16 figs., 10 tables, 2 refs., 6 eqs. **DWB**—This report consists of three basic parts. In the first, average monthly values of relative humidity are presented for between one and four hours of the day at 126 weather observing stations in the southwestern United States, including all of Arizona, New Mexico, Colorado, Utah, and Nevada, and parts of California, Texas, Idaho, and Wyoming. The nature, accuracy, and import of these data are discussed briefly. It is shown that the month with lowest average humidities varies systematically from March in central Texas to Aug. in northern Nevada, antedating the westward movement of the Atlantic high pressure system, with its moist unstable air. In the second section, the distribution of dew point over the Southwest is discussed. High values are found on the windward sides of most of the larger mountain ranges, near bodies of water, and in heavily irrigated farmland; low values are concentrated at higher elevations and in the dry desert regions bounded by the Sierra Nevada Mountains to the west and the Rocky Mountains to the east. Hourly data for Arizona indicate that the diurnal variation of dew point is small, with a tendency for the lowest values to occur in the midafternoon in dry regions and in the early morning in moist regions, i.e., those with a surface snow cover or with considerable crop irrigation. The final section outlines a method of estimating the mean relative humidity from the mean temperature. Ordinary linear regression techniques are used, with a correction added to account for the systematic geographical distribution of regression errors. *Subject Headings:* **1. Relative humidity distribution 2. Dew point 3. Southwestern United States.**—*Author's abstract.*

EVAPORATION AND EVAPOTRANSPIRATION

11.10–352 551.573:551.506.1(267,267.5,267,8)

Privett, D. W. (*Natl. Inst. of Oceanog., Wormley, Surrey*), **Monthly charts of evaporation from the N. Indian Ocean, including the Red Sea and the Persian Gulf.** *Royal Meteorological Society, Quarterly Journal*, 85(366):424–428, Oct. **1959.** 3 figs., 8 refs. **DWB, DLC**—Monthly values of the rate of evaporation from each 5-degree square of the N. Indian Ocean and from the Red Sea and the Persian Gulf have been obtained by using a modified form of Jacob's formula and climatic data supplied by the Meteorological Office. *Subject Headings:* **1. Evaporation over Indian Ocean 2. Evaporation data 3. Indian Ocean 4. Red Sea 5. Persian Gulf.**—*Author's abstract.*

CONDENSATION

See also: **Aircraft observations of rain from layer clouds** (Singleton), 11.10–241.

11.10–353 551.574.1:551.578.41

Nikandrov, V. Ia., **Priroda obrazovaniia kapelek i l'dinok v usloviiakh bol'shikh peresyshcheniĭ.** [Characteristics of droplet and ice particle formation under conditions of considerable supersaturation.] *Leningrad. Glavnaia Geofizicheskaia Observatoriia, Trudy*, No. 73: 3–11, **1958.** 4 figs., 4 tables, 7 refs., 7 eqs. **DWB**—This theoretical investigation of the formation of droplets and ice crystals under artificial conditions of high supersaturation includes the following, viz: the energy of interaction of molecules of water vapor for which the equation $u = \frac{B}{L^{12}} - \frac{K}{L^6}$ is derived (L = distance between centers of molecules; K is given by $u_2 = K/L^6$ where u_2 = potential of van der Waals force attraction, and B is given by $u_1 = B/L^\beta$ where u_1 = potential of mutual repulsion, and $\beta = 12$); the union of water vapor molecules; the formation of independent elementary particles of water with an ice structure at temperatures of −39° to −41°C and the tetrahedral structure of 4 or more H_2O molecules; super growth of molecular associations during condensation; and the physical conditions of the formation of nuclei at the surface of solid CO_2. *Subject Headings:* **1. Drop formation 2. Ice crystal formation 3. Supersaturation.**—*I.L.D.*

11.10–354 551.574.1:546.33:546.13

Papée, Henry M., **Some effects of water-vapor adsorption on sodium chlorides at 25C°** *Journal of Meteorology*, Boston, 16(3):244–248, June **1959.** 5 figs., 25 refs. **DWB, DLC**—The surface of sodium-chloride microcrystals has been "strained" in an electrodeless high-frequency discharge. Surface areas of the blue produce obtained in this way, after exposure to water vapor at 25°C and unit relative vapor pressure, were plotted against time and the rates compared with the sintering rate of a normal surface. Induction periods were found in both cases indicating surface adsorption, during which time the surface does not change appreciably. The rates of sintering were found to differ considerably indicating that sintering of the "blue" surface is much slower than that of the "white" one. Both phenomena were found to follow first-order kinetics with respect to surface. The possible role of activated NaCl in ice nucleation and water coalescence in the atmosphere is discussed. *Subject Headings:* **1. Adsorption of water vapor on sodium chloride 2. Nucleation processes.**—*Author's abstract.*

11.10–355 551.574.1:536.62:546.33:546.13:537.5

Papée, Henry M., **Microcalorimetry of adsorption of water vapor on sodium chloride which has been treated in electric discharges.** *Journal of Meteorology*, Boston, 16(3):295–298, June **1959.** 5 figs., table, 7 refs. **DWB, DLC**—By use of a microcalorimeter of the Calvet type, measurements of the heats of adsorption of water vapor on sodium chloride of large specific surface have been made, after submitting the salt to an electrodeless high-frequency discharge. The results are compared with those previously obtained when working with normal sodium chloride. It is established that the adsorption process is much longer than in the former case and that the heats evolved in, and quantities of water required for, the process of hydration are several times greater than those previously obtained. The appearance of

electrical charges on the "blue" salt, after hydration, is established qualitatively. *Subject Headings:* **1. Microcalorimetry 2. Adsorption of water vapor on sodium chloride 3. Nucleation processes.**—*Author's abstract.*

11.10–356 551.574.1:546.57:546.15

Poppoff, I. G. and Sharp, G. W., **Inhibition of freezing nuclei by adsorbed contaminants.** *Journal of Meteorology*, Boston, 16(3):288–294, June **1959.** 6 figs., 4 tables, 17 refs. **DWB, DLC**—An investigation was made of the effect of amines, ammonia, and alcohols on the nucleation of super-cooled water droplets by silver-iodide crystals. It was found that they inhibit the nucleation and that the vapor concentrations required for inhibition increase as droplet temperatures decrease. Further, it was demonstrated that the adsorption of inhibitor on freezing nuclei is readily reversible and is, therefore, probably physical adsorption of the Van der Waals type, rather than an irreversible chemisorption producing surface complexes. *Subject Headings:* **1. Freezing nuclei 2. Nucleation of supercooled water 3. Silver iodide nucleation.**—*Author's abstract.*

11.10–357 551.508.91 551.574.11

Bigg, E. K. and Meade, R. T. (*both, Radiophysics Laboratory, Sidney, Australia*), **Continuous automatic recording of ice nuclei.** *Puy de Dôme. Observatoire, Bulletin*, No. 4:125–138, Oct./Dec. **1959.** 7 figs., 4 refs. French and English summaries p. 125. **DWB**—Instruments are described which sample air continuously and record the number of ice crystals formed when it is cooled to a predetermined temperature. Their main feature is complete objectivity obtained by standardized humidification of the incoming air, elimination of false counts due to frost formation and production of a legible and permanent record. A detailed description of the equipment and its technique are given. Two types of apparatus were used: the "liquid wall" type and the rolling wiper model. In order to determine the influence of the local weather conditions on the content in natural ice nuclei the author achieved a complex equipment of which he gives a description. Its uses are illustrated by the results of experiments which showed the magnitude and duration of fluctuations in ice nucleus concentration, their relation to local weather conditions, and size distribution of the nuclei involved. *Subject Headings:* **1. Ice nuclei counters 2. Ice crystal nuclei 3. Weather effects on nuclei concentration.**—*A. V. and authors' abstract.*

11.10–358 551.574.1:551.577.11

Semonin, Richard G., **Atmospheric particulates in precipitation physics.** Illinois. State Water Survey, (at Illinois Univ.), Grant NSF G6352, Annual Progress Report, Oct. 7, **1959.** 14 p.—The University of Illinois received funds on Oct. 7, 1958, from the National Science Foundation to initiate and carry forth research, under the direction of the Illinois State Water Survey, pertaining to the number and size distribution of atmospheric particulates and their relationship to cloud and precipitation initiation. Three phases of study, each representing a particular aspect of the research, were initiated. The three phases are the airborne sampling, rainwater sampling, and the analysis of these data. The present report covers each of these individual phases and its progress to date. Future plans for the continuance of research are briefly discussed. *Subject Headings:* **1. Atmospheric nuclei 2. Precipitation physics 3. Cloud physics research.**—*I.S.*

11.10–359 551.574.11:551.576.1

Twomey, S. and Squires, P. (*both, C. S. I. R. O., Div. of Radiophysics, Sydney*), **The influence of cloud nucleus population on the microstructure and stability of convective clouds.** *Tellus*, Stockholm, 11(4):408–411, Nov. **1959.** 2 figs., table, 10 refs., eq. **DLC**—Measurements of the concentration of cloud droplets and of the supersaturation spectrum of the cloud nucleus population in the air below cloud base showed a strong correlation between these properties. It is concluded that variations in the cloud nucleus content of the air are primarily responsible for variations of cloud droplet concentrations and colloidal stability. *Subject Headings:* **1. Cloud nuclei 2. Convective cloud structure 3. Nuclei-droplet relationships.**—*Authors' abstract.*

11.10–360 551.574.11:551.576.1

Twomey, S., **On the nature and origin of natural cloud nuclei.** *Puy de Dôme. Observatoire, Bulletin*, No. 1:1–19, Jan./March **1960.** 5 figs., table, 18 refs. French and English summaries p. 1–2. **DWB**—Laboratory experiments were carried out to determine the possible sources of atmospheric cloud nuclei, i.e. those particles which can nucleate condensation at supersaturation less than 1 per cent. The most important source of such nuclei is apparently the soil surface, which when heated by radiation in dry conditions releases large numbers of cloud nuclei: cracking of salt layers adhering to the surface of soil particles is the mechanism postulated for the production of nuclei in this way. Bursting bubbles at the sea surface also produce cloud nuclei, in numbers which will in general be considerably less than produced by dry land surfaces. Combustion of common fuels also produce cloud nuclei; but the contribution from this source is concluded to be a minor one, except perhaps in heavily polluted air close to major sources of pollution. It is suggested that the presence of vegetation cover over large areas may hinder the production of cloud nuclei and hence prevent the formation of highly stable "continental" clouds, composed of many small droplets. *Subject Headings:* **1. Nuclei sources 2. Cloud nuclei.**—*Author's abstract.*

11.10–361 551.574.12

Mordy, W. A. (*Internat. Met. Inst., Stockholm*), **Computations of the growth by condensation of a population of cloud droplets.** *Tellus*, Stockholm, 11(1):16–44, Feb. **1959.** 25 figs., 2 tables, 36 refs., 12 eqs. **DLC**—The number and size of cloud droplets formed on several condensation nucleus spectra is computed numerically. The relative humidity is treated as a dependent variable and the settling of droplets by Stokes' Law is accounted for. A model is presented for studying simultaneous variations in vertical velocity, nucleus distribution, and humidity by the use of an electronic computer. To date eight computations have been made for three types of nucleus spectra at different rates of rise. Both nucleus distribution and rate of rise produce significant differences in resulting cloud droplet distributions. The concentration of cloud droplets computed ranges from 1 cm^{-3} to 470 cm^{-3} for vertical velocities ranging from 5 cm/sec to 100 cm/sec. *Subject Headings:* **1. Cloud droplet formation 2. Stokes' law 3. Condensation nuclei.**—*Author's abstract.*

FOG

See also: **Precipitation of fog by means of dry ice** (Soulage), 11.10–255.

11.10–362 551.575.1:551.591.1:551.509.615

†Israël, Hans and Kasten, Fritz, **Die Sichtweite im Nebel und die Möglichkeiten ihrer künstlichen Beeinflussung.** [Visibility in fog and possibilities of artificially influencing it.] *North Rhein-Westphalia, Germany. Ministerium f. Wirtschaft und Verkehrsministerium, Forschungsberichte*, No. 640, **1959.** 76 p. 20 figs., 3 tables, bibliog. p. 68–76. 30 eqs. **DWB** (M75.1 185si)—The contents of this theoretical and experimental study on artificial control of visibility in fog comprise the following, viz: a detailed presentation of Koschmieder's theory of horizontal visibility and measurement of visibility by means of Koschmieder's formula; the relationship between visibility and the physical magnitude of fog such as drop radius, drop concentration, and water content; the Trabert formula for measuring light extinction; the effect of external influences upon visibility, namely evaporation of drops by raising the temperature of the surrounding air above the dew point or evaporation by diffusion (seeding the fog with particles with a lower vapor pressure than the fog droplets), mechanical removal of fog particles by increasing fog droplet size through "internal coagulation" of fog (turbulence or electrical neutralization of fog); enlargement of fog droplets by condensation, removal of fog drops by condensation with large water drops freely falling through the fog; cloud (fog) dissolution by rain including temporal change of water content of a cloud by falling rain and cloud dissolution by natural rain; precipitation production in a cloud by artificial rain (seeding with water drops); laboratory experiments for improving visibility in clouds, including production of a constant cloud of temporally constant visibility; measurement of visibility and droplet size, the artificial control of laboratory fog by seeding with active-surface powder, and seeding with an active-surface solution; field experiments for improving visibility in fog including

comparison of laboratory with natural fog, description of water ejectors employed in the field experiments and the results of the field experiments. The field experiments showed that the water ejectors had no influence upon fogs with a visibility of 300–400 meters. In the only instance of a fog with a visibility of less than 100 meters visibility was improved by 10–15%. *Subject Headings:* **1. Visibility in fog 2. Fog particle investigation 3. Artificial fog dissipation.** —*I.L.D.*

11.10–363 551.511.33:551.575.1

Koshelenko, I. V., **O roli advektsii tepla v obrazovanii advektivnogo tumana.** [Role of heat advection in the formation of advection fog.] *Kiev, Ukraine. Nauchno-Issledovatel'skiĭ Institut, Trudy*, No. 5:159–169, **1956.** 6 figs., table, 3 refs., 11 eqs. **DWB, DLC**—A theoretical and practical study of the problem in which it is shown that although advective fogs originate as a result of active heat exchange between the underlying surface and the air layer near the ground in the presence of moisture, they do not occur with all types of heat advection. *Subject Headings:* **1. Advection of heat 2. Advection fog.**—*A.M.P.*

CLOUDS

See: **Cloud layer of Venus** (Kuiper), 11.10–103; **Cloud patterns in Hurricane Daisy** (Malkus et al.), 11.10–295; **Absorption of shortwave rad. by clouds** (Möller), 11.10–317; **Nuclei and convective clouds** (Twomey, Squires), 11.10–359.

PRECIPITATION

See also: **Radioisotopes in the atmosphere** (Lal et al.), 11.10–58; **Intense rainfall at Mt. Fuji** (Arakawa), 11.10–127; **Atmospheric particulates in precip. physics** (Semonin), 11.10–358; **Humid tropical Africa** (Marlier), 11.10–382.

11.10–364 551.577.22:551.501.45

Steinhäusser, Hans, **Trocken- und Niederschlagsperioden und ihre theoretische Behandlung.** [Dry and wet periods and their theoretical treatment.] *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. B*, Vienna, 10(1):38–58, **1959.** 7 tables, 12 refs., 25 eqs. German, English and French summaries, p. 38–39. **DWB, DLC**—The observed number of dry and wet periods of a certain length and minimum length as well as the mean duration of the periods are compared with the expectation values of the theory of L. v. Bortkiewicz. No satisfactory agreement was found. The result was the same with regard to a Poisson distribution. If a possible concatenation of the characteristics "dry" or "wet" of successive days is taken into account according to the theory of probability contagion, theory and observation are in much better agreement. To extend the theory it must be considered that the mean duration of the periods varies with different types of weather conditions and that a concatenation, beyond the order of magnitude of the period duration, is caused by a greater frequency of certain weather situations. The theory leads to composite Poisson distributions. Numerical values of the mean period duration with different types of weather situations are not yet available. *Subject Headings:* **1. Dry periods 2. Rainy spells 3. Persistence.**—*Author's abstract.*

11.10–365 551.577.36(773):519.24

*Huff, F. A. and Neill, J. C., **Frequency relations for storm rainfall in Illinois.** *Illinois. State Water Survey Div., Bulletin*, 46, **1959.** 65 p. 16 figs., 36 tables, 14 refs. **DWB, DLC**—Annual and seasonal maximum precipitation data for 39 stations in Illinois were used for the 10-year period 1916–1925 in order to determine the recurrence interval of heavy precipitation for periods of 1–10 days. Illinois was divided into four regional zones. Various methods of analysis were tested and compared, statistical theory is explained in detail and examples of statistical tests and comparisons given in tables and on charts. Gumbel's extreme value method, Frechet's method, Jenkinson's Extreme Value method and Empirical techniques were tested. Most of the analyses followed Gumbel's method based on goodness of fit of actual data. Graphical methods proved satisfactory when frequencies alone are desired, but when reliabilities are to be determined there must be a mathematical analysis. Little

difference in sectional precipitation frequency relations was found between a 20 year and a 40 year record. *Subject Headings:* **1. Storm rainfall frequency relations 2. Precipitation probabilities 3. Illinois.**—*M.R.*

11.10–366 551.577.36(944):519.24

O'Mahony, G., **The estimation of maximum probable precipitation by statistical methods.** (In: Australia. Bureau of Meteorology, **Conference on estimation of extreme precipitation, Melbourne, April 1958.** Melbourne, Dec. **1958.** p. 69–90. 4 figs., 4 tables, 2 refs., eqs.) **DWB** (M77.31 C748c)—A detailed presentation and discussion of statistical-empirical method for determining maximum probable precipitation for a given return period (confidence limits of .01 and .001) using actual records for Dorrigo, N.S.W., 1914–57, and for Pallamallawa, N.S.W., 1914–1956. The curves are shown on ordinary and on log scale and then a straight line log-normal distribution curve is drawn for each of the 2 records. The log normality is tested statistically. Limitations are due to spread or scatter, and to short period of record (<50 years), to use of 9 a.m.–9 a.m. rather than true 24-hour rains, and to the use of point rather than area rainfall. At 95% probability, several of the extreme rains on record have not been predicted. *Subject Headings:* **1. Maximum probable precipitation estimates 2. Log-normal rainfall distribution 3. New South Wales.**—*M.R.*

11.10–367 551.577.37:534.2:551.463

Heindsmann, T. E.; Smith, R. H. and Arneson, A. D., **Effect of rain upon underwater noise levels.** *Acoustical Society of America, Journal*, 27(3):378–379, March **1955.** 4 figs., refs. **DLC**—Measurements during two heavy rainstorms through an off-shore calibrated hydrophone system showed an increase of up to 25 db in the 20 to 20,000 cps band pressure level as compared to the ambient level before and after. During the period of heaviest rainfall the pressure spectrum level was approximately constant at -23 db/1 dyne/cm^2 from below 1 kc to above 10 kc, and apparently extends to beyond 40 kc. The pressure spectrum level of the ambient noise can be calculated from the wind force and from a reasonable estimate of the intensity of rainfall. *Subject Headings:* **1. Rainfall effects on underwater noise 2. Acoustics.** —*Authors' abstract.*

11.10–368 551.577.37:551.594.221:551.515.4

Parczewski, Władysław (*Central School of Rural Economics, Warsaw*), **Intensity of precipitation and frequency of electric discharges in thunderstorms.** *Időjárás*, Budapest, 62(4):189–194, July/Aug., **1958.** 3 figs., 7 refs. German summary p. 189; Hungarian summary p. 193. Also (in slightly more detail) in *Acta Geophysica Polonica*, Warsaw, 7(3/4):391–400, **1959.** 6 figs., table, 8 refs., 2 eqs. Polish summary p. 400. Also (in Polish) as Natężenie opadu burzowego a częstotliwość wyładowań elektrycznych. *Przegląd Geofizyczny*, Warsaw, 3(3/4): 209–227, **1958.** 5 figs., 12 tables, 9 refs., 2 eqs. French and Russian summaries p. 219. **DWB, DLC**—During the summer of 1955 lightning discharges during thunderstorms (at Pulawy and Rabka) were timed with the help of a stop watch and compared with the pluviograph records. A definite correlation is found to exist between precipitation intensity and lightning discharges. The relation is believed to be linked to vertical currents inside the thundercloud. It is suggested that the potential of discharges during thunderstorms could be determined by means of pluviogram analysis. *Subject Headings:* **1. Thunderstorm rainfall intensities 2. Lightning frequencies 3. Precipitation intensity-lightning discharge correlations 4. Poland.**—*G.T.*

RAIN, SNOW AND HAIL

See also: **Highway planning Wr. Neustadt-Oberwart** (Friedrich), 11.10–54; **Arctic circulation studies, visibility in blowing snow** (Reed), 11.10–287; **Thunderstorm at Wittenberg and its effects** (Schütze), 11.10–302.

11.10–369 551.578.41

§Lumb, F. E., **Cotswolds snowfall of Nov. 1, 1942.** *Meteorological Magazine*, London, 89(1050):11–16, Jan. **1960.** 7 figs., 2 tables, 3 refs., 4 eqs. **DWB, DLC**—A cursory examination of the synoptic charts for 0700 and 1300 G.M.T. on Nov. 1, 1942, and of the Larkhill

upper air sounding at 1100 G.M.T., suggests that the snow at Little Rissington had penetrated downwards 1,500 m below the wet-bulb freezing level. A closer examination of the evidence shows that it is most unlikely that the snow penetrated downwards more than 600 m (70 mb) below the wet-bulb freezing level. *Subject Headings:* **1. Snowfall above freezing temperature 2. Cotswolds, England.**—*Author's abstract.*

11.10–370 551.578.41:778.14:551.510.53

†Murai, Gorow, **On the relation between natural snow crystal forms and the upper-air conditions.** *Low Temperature Science, Ser. A*, Sapporo, Japan, No. 15:13–32, **1956.** 29 figs., 21 photos, table, 34 refs. In Japanese; English summary p. 31–32. **DWB, DLC**—The relation between snow crystal types, cloud form, and the temperature and humidity of the snow-generating level is examined on the basis of radiosonde measurements at Sapporo (Japan) during the winter of 1955–56. Needle crystals occurred most frequently at a temperature of −8°C in the generating level, dentrites at −14° to −16°C, plates at −18° to −20°C, columns at −23° to −25°C, and spatial plates at −20° to −24°C, agreeing well with the results obtained by Nakaya. The relative humidity with respect to ice at which the crystals were observed ranged from 81–120%. Dentrites, spatial dentrites, and irregular crystals were mainly produced in convective clouds, while columns, needles, and spatial plates formed in stratiform clouds. Data on cloud thickness, temperature, and humidity, the relation between crystal types and cloud forms, upper air conditions under which various crystal forms were observed, and the distribution of crystal types with temperature and relative humidity with respect to ice are tabulated and graphed, and photographs of the crystals are presented. *Subject Headings:* **1. Snow crystal forms 2. Cloud types 3. Photomicrographs.**—*SIPRE abstract No.* 15678.

11.10–371 551.578.45(791)

Quiroz, Roderick S. (*Climatic Center, Hq., Air Weather Service*), **Record snowfall in sunny southern Arizona.** *Weatherwise*, Boston, 12(2):49–50, April **1959.** photo, table, 2 refs. **DWB**—On Nov. 16, 1958, the heaviest snowfall ever recorded in Tucson, Ariz., since records began in 1897, and the first ever recorded in November, occurred. Snow fell all over Arizona that day. Damage to crops was not great. Trees were broken in Tucson and cotton harvest was retarded. Three thinly clad Boy Scouts were lost on Mt. Baldy near Tucson (elevation 9400 ft). Many others were temporarily lost. A contingency table shows frequency of 24-hour snow amounts at Tucson (1931–1958) in different class intervals. Maximum of 6.4 in. exceeds previous maximum of 3.5 in. on Jan. 25, 1949. Surface synoptic conditions are quite varied but 500-mb conditions are more uniform. A closed center low and temperatures of $< -30°$ at Tucson up to 48 hours before snow began. This proved to be a necessary but not a sufficient condition for snow at Tucson. *Subject Headings:* **1. Record snowfall—Tucson, Ariz. —Nov. 1958 2. Snow fall extremes 3. Tucson, Ariz.**—*M.R.*

11.10–372 551.578.46(71)

Potter J. G. (*Met. Br., Dept. of Transport, Toronto*), **Mean duration and accumulation of snow cover in Canada.** *International Union of Geodesy and Geophysics. Assoc. of Scientific Hydrology, Toronto, Sept. 1957,* [*Transactions*], Vol. 4, pub. **1958.** p. 82–87. 5 figs., 2 refs. **DWB, DLC**—With the numerous meteorological observing stations established in Northern Canada during the war years, and the more detailed observing program for snow cover adopted in 1941, data are now available for the first time on the mean duration and accumulation of the winter's snow cover. Data for 15 winters serve as the basis for discussion of the general features of the duration and depth of snow cover in Canada. Among the charts included are those illustrating the mean dates of the beginning and ending of the winter snow cover, annual duration of snow cover, and the mean accumulation of snow on the ground. *Subject Headings:* **1. Snow cover duration 2. Snow cover depth 3. Snow accumulation 4. Canada.**—*Author's abstract.*

11.10–373 551.515.4:551.578.7 551.578.71:551.574.1

Soulage, G., **Influence de l'aérosol atmosphérique sur la formation de la grêle, II, Noyaux de congélation géants et noyaux de condensation à proximité d'orages à grêle.** [Influence of

atmospheric aerosol on hail formation, Pt. 2, Giant freezing nuclei and condensation nuclei in the vicinity of hailstorms.] *Puy de Dôme. Observatoire, Bulletin*, No. 4:139–146, Oct./Dec. **1959.** fig., 2 tables, 7 refs. French and English summaries p. 139. **DWB**—Measurements of the concentration of condensation nuclei and "giant" freezing nuclei have been carried out in 1958 at the summit of the Puy de Dôme. The experimental conditions are described and the method used to count the condensation nuclei is exposed. Results of counts do not show a clear relation between hail and the condensation nuclei and "giant" freezing nuclei content of atmospheric aerosol. However, the concentration of the "giant" freezing nuclei for hailstorms is frequently found to be lower than both its mean value and its value for storms without hail. It is concluded that the factor "condensation nuclei" and "ice forming nuclei" does not seem to have a primordial influence on the form of precipitation. This does not mean that one cannot diminish hail through seeding with artificial ice forming nuclei. On the contrary, the small variation in the ice forming power observed at the time of hail formation permit to expect, at least in certain cases, an effect with a content in the range of 10 active nuclei at −15°C per liter. In the same manner the small variations in the "giant" freezing nuclei content suggest another prevention process using such nuclei. *Subject Headings:* **1. Hail formation 2. Giant nuclei 3. Freezing nuclei content of atmospheric aerosol 4. Hail prevention 5. Hailstorms.**—*A.V. and author's abstract.*

11.10–374 551.578.73(436.14)

Cehak, Konrad (*Zentralanstalt f. Met. & Geodyn. Vienna*), **Der Hagel im Wiener Becken.** [Hail in the Vienna Basin.] *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. B*, Vienna, 9(3/4):340–359, **1959.** 6 figs., 15 tables, 10 refs., eqs. German, English and French summaries, p. 340–341. **DWB, DLC**—On the basis of the statistics of damages of the Austrian Hail Insurance Company, 1952–1956, frequency distributions of hail damages in the basin of Vienna were evaluated. For longer periods the annual probability of hail in Vienna was expressed by a Poisson distribution. A map represents the local distribution of hail risk in the basin of Vienna, showing two regions especially endangered. Further it has been shown that hailstorms occur especially with the weather situations HN, TK, TR, Vb and TB. The upper wind from southeast was found to be especially conducive to the occurrence of hail. A mean sounding was evaluated for days with widespread hail activity. By means of a thetagramm it was attempted to determine which air masses occur in weather situations and with upper winds which promote the occurrence of hail. It is found that nearly always tropical air masses, being overheated in layers near the ground, participate in large hailstorms. *Subject Headings:* **1. Hail frequency distribution 2. Hail damage 3. Vienna, Austria.**—*Author's abstract.*

CLIMATOLOGY AND BIOCLIMATOLOGY

CLIMATOLOGY

11.10–375 551.58:519.242

Srinivasan, T. R. (*Met. Office, Poona*), **A statistical model suitable for describing weather persistence.** *Indian Journal of Meteorology and Geophysics*, Delhi, 10(3):321–324, July **1959.** table, 4 refs., 15 eqs. **DWB, DLC**—Persistence is a factor of major importance in meteorological studies. In a system where there is no persistence, the probability p of occurrence of an event and $q(=1-p)$ that of non-occurrence are independent of what has happened previously. It can be easily seen that the cumulative frequencies Fn of occurrences of runs of length n or more are terms of the geometric series F, pF, p^2F so that the ratio of the successive terms of the actual cumulative frequency distribution provides an estimate of the probability p. However, in persistent series such as are usually met with in meteorology the ratios of the cumulative figures are not constant and this feature which is brought about due to the effect of persistence requires to formulate a different model. Newnham (1916) assuming that the probability continuously increases with the length of runs worked the persistence of wet and dry weather at 50 stations. Gold (1929) discussed the problem when runs are restricted by the length of series and studied the frequencies of occurrence of sequences in a series of events of two types with equal chance of occurrence and non-occurrence. Cochran (1936)

made a notable contribution on the subject by extending it to unequal chances and applied it for the study of wet and dry sequences. Here with p the probability of the occurrence, x the duration of the spell and m the number of units of time (days) in the restricted series (season) and n the number of series (seasons or years), the frequency of spells of length x units is given by $S_2 = n[p^2q\{2+q(m-x-1)\}]$. WILLIAMS (1952) studied the behavior of certain weather spells exhibiting tendency to persist by fitting logarithmic series xp^x/X for frequencies of runs of length x; the parameters x and p being easily determined from the frequencies and the first moment of the distribution. In analyzing sequence of wet spells and dry spells in respect of some of the Indian stations, it has been found that the geometric series gives a good fit, in some logarithmic series, while in some others either of these fails to give a good fit. It has thus become necessary to search for more suitable models; a generalized model has been described and a method of deriving the parameters has been worked out. *Subject Headings:* **1. Persistence 2. Series analysis 3. India.**—*Author's abstract.*

CLIMATE OF PARTICULAR PLACES

See also: **Climate of Ukraine** (Huk et al.), 11.10-5; **Climate of Paris Basin** (Pédelaborde), 11.10-7; **Climate of Sahara** (Dubief), 11.10-8; **Survey of soils in Tanganyika** (Anderson), 11.10-9; **Linz weather observations of J. Kepler** (Grammer), 11.10-22; **Falkland Island Dependencies Survey 1944–1955** (Maling), 11.10-231.

11.10–376 551.582.1(472.2)

*Kirde, Karl, **Andmeid Eesti kliimast.** [Data on the climate of Estonia.] *Tartu. Ülikool, Acta et Commentationes Universitatis Tartuensis (Dorpatensis), Ser. A*, 34(8) **1940.** 152 p. 100 figs., 104 tables. In Estonian; English summary p. 136–152. **DLC** (AS262.T22A22) – An unusually thorough monograph analyzing and presenting all available climatic data for Estonia using up to 70 years of records (1866–1935) for 27 stations. Analytical tables, isoline charts, time cross sections and statistical analysis of frequencies or probabilities at various levels are included most of the data for Tartu. *Subject Headings:* **1. Climate of Estonia 2. Estonian S.S.R.**—*M.R.*

11.10–377 551.582.2:551.521(436)

*†Sauberer, F. and Dirmhirn, Inge, **Das Strahlungsklima.** [Radiation climate.] (In: Steinhauser, Ferdinand, et al. (eds.), **Klimatographie von Österreich** (issued as *Akademie der Wissenschaften, Vienna, Denkschriften*, Vol. 3, pub. **1958.**) p. 13–102. 21 figs., 73 tables, 71 refs.) **DWB, DLC**—This is a comprehensive radiation-climatological survey of Austria and is based upon extensive analysis and evaluation of the available data and more recent investigations and measurements. These comprise light intensity, insolation, sky radiation, effective outgoing radiation, radiation balance including radiation in water, snow and vegetation, spectral measurements, counter radiation, albedo of different surfaces, recordings of "Vorderlicht," light-electrical recordings, global radiation measurements, and some special measurements. The detailed results are presented in graphs and tables. *Subject Headings:* **1. Radiation climatology 2. Austria.**—*W.N.*

CLIMATIC CHANGES

11.10–378 551.583.3:551.311.2:551.351(265)

Hopkins, David M. (*U. S. Geological Survey, Menlo Park, Calif.*), **Cenozoic history of the Bering land bridge.** *Science*, Wash., D. C., 129(3362):1519–1528, June 5, **1959.** 5 figs., 49 refs. **DLC**—A wide treeless tundra land bridge existed across the Bering and Chukchi seas during Tertiary and Quaternary from 50 million years ago down to the end of the Wisconsin glaciation (10,000–11,000 B.P.). Evidence is cited from geology, glaciation, flora and fauna, marine soundings (showing only 100–500 ft of water over the Bering-Chukchi platform), beaches and sediments. A submarine escarpment >5000 ft high lying across Bering Sea separates the Oceanic structure of the Western Bering Sea from the Continental structure of the flat arcless platform. Although Eastern Siberia and Alaska are geologically a single structure, the Bering Strait has been temporarily submerged, several times in the past 50–60 million

years during the interglacial periods. Marine sediments at Nome show three times when water temperatures were higher than at present (in Pleistocene), allowing Pacific species to cross into the Atlantic for the first time. Sea level, glacial forest and climatic conditions are also discussed. On the bridge summers were short and cold and winters as cold as at present. *Subject Headings:* **1. Bering-Chukchi land bridge 2. Pleistocene climates of Bering Strait 3. Bering Strait 4. Seward Peninsula, Alaska.**—*M.R.*

MICROCLIMATOLOGY

See also: **Meteorology of air layer near ground** (Leningrad. GGO), 11.10–1; **Los Angeles atmosphere** (Rogers), 11.10–259; **Effect of humidity on heat exchange of lightly clothed men** (Iampietro et al.), 11.10–381.

11.10–379 551.584.5:69.023.6

Rudeĭko, V. A., **Gigienicheskaia otsenka mikroklimata zhilogo kvartala zamknutoĭ perimetral'noĭ zastroĭki s arkami.** [Hygienic evaluation of the microclimate of a residential block having archways.] *Leningrad. Sanitarno-Gigienicheskiĭ Meditsinskiĭ Institut, Trudy,* 25:205–212, **1956.** 3 figs., 2 tables, 5 refs. **DLC**—Temperature and wind movement were recorded at places in and around buildings having archways. It was found from model studies that the air circulation inside the building was not increased substantially by an archway unless the distance between the peripheral buildings was >5 times their height. No effect at all is found where the space is narrow. The effect of the arch, with light wind, is not felt more than 10 m inside the court. Temperatures are not affected in February or April but in June there is a difference of nearly 1° between quarters on one side from those on the other side of the court, depending on the direction and speed of the wind. Effects on different quadrants are shown in tables and diagrams. *Subject Headings:* **1. Urban climates 2. Dwelling microclimatology 3. Arch effects on wind and temperature 3. Model experiments.**—*M.R.*

11.10–380 551.509.5(235.1):551.584.31

Podol'skiĭ, A. S., **Nekotorye osobennosti klimata gornykh sklonov.** [Certain characteristics of the climate of mountain slopes.] *Akademiia Nauk SSSR, Izvestiia, Ser. Geografich.,* No. 4:85–89, July/Aug. **1959.** 4 figs., 5 tables. **DWB**—The author presents the results of meteorological observations on mountain slopes and aerological observations carried out simultaneously in 1952 by the meteorological service of the Elbrus Expedition of the Geophysical Institute of the Academy of Sciences of the USSR. Observations were made on mountain slopes namely, the Terskol Observatory (2190 m), meteorological station of Terskol Peak, 2–2.5 km from the observatory at 740 m and at the Elbrus Observatory at 1890 m and at the same elevations in the free atmosphere by means of balloon soundings. The variations of differences of temperature (t_0-t) and specific humidity (q_0-q) averaged per month in the free atmosphere and on Terskol Peak indicate that in spring and probably in winter the differences are positive (the free atmosphere is warmer than the slopes) and in the summer they are negative. The mean differences t_0-t are small, although in individual instances they attain $\pm 4°$ to $\pm 5°$C. The variation of specific humidity difference shows Terskol Peak is more humid than the free atmosphere during May–September, especially in summer. The mean value of q_0-q is slight, in individual cases it reaches -3.5 and $+1.5$ g/kg. Hourly averages of t_0-t and q_0-q indicate that morning, evening and night is warmer than the slope and by day colder. The time of maximum absolute value of the difference q_0-q coincides approximately with the time of maximum absolute value t_0-t, i.e. 1300 o'clock. Cloudiness of 6–10 balls, especially in the middle layer can level out the daily temperature difference between slopes and free atmosphere. Cloudiness, by hindering warming and reducing evaporation, diminishes q_0-q the more so that in cloudy weather q_0 increases. Precipitation levels out differences in temperature and humidity of the underlying surface and the free atmosphere at any time. During westerly flow from the Atlantic ocean the free atmosphere is quite humid and differs little from the air directly in contact with the surface of Terskol Peak. No perceptible relationship was established between the magnitude t_0-t and q_0-q and wind velocity. The relationship between the temperature and humidity on the glacier surface near the Elbrus Observatory and the free atmosphere shows a different picture. The results of measurements are presented

in graphs and tables. *Subject Headings:* **1. Slope microclimatology 2. Mountain observations 3. Elbrus Mountain.**—*I.L.D.*

CLIMATIC CLASSIFICATION

See: **Photography in humid tropical climate** (Naturw. Rundschau), 11.10–55; **Biological problems in humid tropical Africa** (Marlier), 11.10–382.

BIOCLIMATOLOGY

See also: **Life and light** (Wald), 11.10–68; **Ecospheric planets** (Gadomski), 11.10–101; **Signs of life on planets** (Popov), 11.10–102; **Air pollution in Budapest** (Péczely), 11.10–258; **Atm. conditions during föhn weather** (Reifferscheid), 11.10–339.

11.10–381 551.571.36:551.584.9:646 551.586:646

Iampietro, P. F.; Buskirk, E. R. and Vaughan, J. A., **Effects of high and low humidity on heat exchanges of lightly clothed men.** *U. S. Quartermaster Research and Engineering Center. Environmental Protection Research Div., Technical Report EP*-151, April **1960.** 6 p. 3 figs., 2 tables, 4 refs. **DWB** (M86.Ur85t)—Six healthy young men were exposed, lightly clothed, to various combinations of wind (<1 and 10 mph), temperature (40 and 50°F) and relative humidity (30 and 100%). Skin and rectal temperatures and oxygen consumption were recorded. The results show that relative humidity had no effect on the physiological responses measured, whereas wind and dry bulb temperature had marked effects. This follows the pattern seen when men were exposed without clothing, and indicates that, under chamber conditions, there is little interaction between clothing and humidity that could account for cold-wet "chill." The importance of considering radiation in any comparison of cold-wet and cold-dry environments is discussed. *Subject Headings:* **1. Relative humidity variations 2. Clothing climate 3. Human climatology 4. Chilling.**—*Authors' abstract.*

11.10–382 551.585.9(6) 551.577.32:551.311.1 551.586

Marlier, G. (*Inst. pour la recherche scien. en Afrique centrale, Congo belge*), **Rapport sur les problèmes biologiques de l'Afrique tropicale humide.** [Report on biological problems in humid tropical Africa.] (In: UNESCO, **Problems of humid tropical regions.** Pub. Paris, UNESCO: London, H.M. Stationery Office, **1958.** p. 57–62. English summary p. 62.) **DLC** (SB111.U56)—This report gives a brief outline of the present conditions including recommendations by which scientific research and countermeasures will become a valuable aid. The problems are discussed in the following order: 1) Systematic inventory of natural species and resources, 2) productivity of soil and water courses, 3) erosion and the rain water cycle, 4) nature conservation, 5) climate and its influence on man and animals and 6) problems of human nutrition. *Subject Headings:* **1. Humid tropics research 2. Bioclimatology 3. Africa.**—*W.N.*

UPPER AIR CLIMATOLOGY

See: **ABMA climatological ringbook** (U. S. Army Ballistic Missile Agency), 11.10–256.

SYNOPTIC CLIMATOLOGY

See also: **Climate of Paris Basin** (Pédelaborde), 11.10–7.

11.10–383 551.509.318:551.589(437)

Rein, František (*Geophysical Inst., Czech. Acad. Sci., Prague*), **Weather typing with regard to dynamic climatology.** *Studia Geophysica et Geodaetica*, Prague, 3(2):177–194, **1959.** 3 figs., 4 tables, 3 refs. Russian summary p. 194. **DWB**—The typing of the synoptic situations over central Europe is applied to the whole climatological network of Czechoslovakia to obtain dynamic-climatological characteristics. Nineteen synoptic types are chosen; a calendar for the time-period 1950–1956 is constructed for them, and some of its statistical features are analyzed. It is concluded that, 1) the relation of anticyclonic vs cyclonic types is 1:2; 2) fre-

quent types are Wc (326 of 2557 cases), H (281 c.), SWc_1, (223 c.) BC (210 c.) and NWc (206 c.), and rarest are 0 (24 c.) and Sa (42 c.); 3) persistent types are SWa, WC, SWc_1, BC, NWc; 4) 8 of 19 types are important for frequency, contain 65% of the whole period treated; 5) the most frequent types gain maximum frequencies because of one or two day periods; 6) some types never change into certain other types (Wc has no transition into SA, SEa, Ea and NEa, etc.), there is an almost regular alternation of the types Wc and H (or Wa). *Subject Headings:* **1. Dynamic climatology 2. Weather types.**—*I.S.*

MISCELLANEOUS

COSMIC INFLUENCES

See also: **Sunrise and eclipse effects on ionosphere** (Bowman), 11.10–142; **Solar corpuscular infl. on circulation at 300 mb** (Macdonald, Roberts), 11.10–320.

11.10–384 551.590.21

Trenkle, Hermann (*Offenbach*), **Hat gesteigerte Sonnenaktivität Einfluss auf das Wetter?** [Does increased solar activity influence the weather?] *Naturwissenschaftliche Rundschau*, Stuttgart, 12(8):309–310, Aug. **1959. DWB, DLC**—The mechanism of solar action upon the weather given primary attention in this paper is the following: increased UV radiation during solar eruptions leads to a warming of the ozonosphere which is transmitted to lower layers. The warming is strongest in equatorial regions, creating an intensification of the temperature contrast and of the pressure gradient from the equator to the poles. This in turn brings about a strengthening of the westerlies. Stronger westerly circulation in fall or early winter will place Central Europe under the influence of mild oceanic air masses. Thus solar activity can determine the weather character of winters over a large part of Europe. Other possible solar effects upon the general circulation are mentioned. *Subject Heading:* **1. Solar-weather relationships.**—*G.T.* Ⓢ

VISIBILITY

See: **Arctic circulation studies, visib. in blowing snow** (Reed), 11.10–287; **Visibility in fog and its artificial modification** (Israël, Kasten), 11.10–362.

OPTICAL PHENOMENA

See also: **Radiation from atmosphere with Rayleigh scattering** (Coulson et al.), 11.10–2; **Measurements and estimates of sky brightness** (Hulburt), 11.10–228.

11.10–385 551.593.51

Walden, H., **Der grüne Strahl.** [The green flash.] *Wetterlotse*, Hamburg, No. 133:157–160, July **1958. DWB**—The phenomenon called green flash, which appears as a bubble of emerald-green, then often shifts to cobalt- and violet-blue of the last portion of the sun's disk immediately after sunset, or in reverse order immediately before sunrise, is described and optically explained. *Subject Heading:* **1. Green flash.**—*O.T.*

11.10–386 551.593.51

O'Connell, D. J. K., **The green flash.** *Scientific American*, N. Y., 202(1):112–122, Jan. **1960.** photos. **DWB, DLC**—The green flash, so familiar to the ancients and moderns, is described. There are various theories about it, but it can be described by the laws of physics. When the rays of the sun enter earth's atmosphere they undergo refraction. The reason for the green flash is that the atmosphere filters out the other colors and the green color appears suddenly. The same phenomenon works in the case of planets. The duration of the flash depends on the rate at which the sun is sinking below the horizon. It is a wholly atmospheric phenomenon depending not only on the lower layers of air but also on conditions at very high levels. Diagrams and photographs of the flash are included. *Subject Heading:* **1. Green flash.** —*A.H.K.*

ELECTRICAL PHENOMENA

See also: **Yearbook for 1959** (France. Bureau des Longitudes), 11.10–61; **Current-jet hypothesis of whistler generation** (Hoffman), 11.10–209; **Planetary influences on atm. electricity** (Budai), 11.10–293; **Intensity of precip. and frequency of discharges in thunderstorms** (Parczewski), 11.10–368.

11.10–387 551.594.221

Norinder, Harald and Vollmer, Burghardt, **Variation forms and time sequence of multiple lightning strokes.** *Arkiv för Geofysik*, Stockholm, 2(25):515–531, **1958.** 22 figs., 8 refs. **DLC**—A knowledge of the time sequence and variation forms of multiple lightning strokes is important in dealing with noise levels due to lightning discharges. Accordingly the Institute for High Tension Research in Sweden during the thunderstorm season of 1953–1955, investigated the time sequence and variation forms of multiple lightning by means of the frame aerial method combined with amplifiers and cathode ray oscillographs. Variation forms of magnetic fields and currents in multiple strokes are described with the aid of diagrams showing multiple strokes with steep and flat forms with pulsing magnetic fields. By means of a sweep generator with a sweep time as low as 0.2 seconds, the time sequence of multiple strokes and total duration of lightning discharges was investigated. A statistical analysis indicates that the frequently recurring time varies around 30 milliseconds, with exceptionally longer differences of 150 milliseconds, the total duration reached values between 200 and 300 milliseconds; most of the numbers being dispersed below 100 milliseconds, and the amplitude of scattering of multiple strokes is characterized by a typical predominance of the field intensity for strokes occurring earlier in the flash. *Subject Headings:* **1. Multiple lightning strokes 2. Lightning forms 3. Lightning flash duration.**—*I.L.D.*

11.10–388 551.594.221

Norinder, Harald and Knudsen, Edgar, **Pre-discharges in relation to subsequent lightning strokes.** *Arkiv för Geofysik*, Stockholm, 2(27):551–571, **1958.** 22 figs., table, 12 refs. **DLC**—The phase structure of individual lightning strokes and the difficulties encountered in recording the pre-discharge stage are discussed. Some 500 separate oscillograms of pre-discharge, of which 200 represent pre-discharges without subsequent main or partial discharges, were examined. Three different variation types of pre-discharges could be determined; two occur in discharges with main and partial discharges and in those where the latter are lacking, the third is characterized by very rapid field changes and appears during the period of the pre-discharge just before the main discharge. The characteristics of these three variation types are discussed, with the aid of oscillograms, the statistical distribution of the time intervals between field intensity variations in the three types of pre-discharges, is analyzed. In the case of a specific thunderstorm in which pre-discharges were without subsequent main and partial discharges, the maximum field intensity was approximately 15 percent of the corresponding field intensity for main and partial discharges, measured at some distance from the discharge center. The variation with time of number of consecutive pre-discharges, the physical reason for pre-discharges without subsequent main and partial charges, the relation of maximum magnetic field intensity amplitudes for pre-discharges and the subsequent main discharge, the polarity relationship between the pre-discharge and subsequent main discharge, and the relation between pre-discharges and rain level are discussed. *Subject Headings:* **1. Lightning discharges 2. Lightning pre-discharges 3. Lightning strokes.**—*I.L.D.*

AURORAS

See: **Sec. D/3,** p. 1615.

PART II. BIBLIOGRAPHY ON THE USE OF SATELLITES IN METEOROLOGY

By: Elemer Kiss

INTRODUCTION

The use of rockets during World War II, and the scientific results obtained from their use in the late 40's and in the early 50's gave impetus to satellite construction and use during and since the IGY.

This compilation of abstracts covers a comparatively short period from 1955 to 1960. Satellite research has been one of the prominent features in the program of the International Geophysical Year, 1957/1958. The accumulation of material has increased enormously since the launching of the first artificial earth satellite (Soviet satellite, 1957 Alpha, i.e., Sputnik I). Publications before Dec. 1957 treated the theoretical aspects of satellites generally; after the launching of the first satellite the observations, data, techniques and methods, instrumentation and elements measured have been emphasized.

Not all recent literature in this field has been included. This bibliography is limited to papers dealing with the use of satellites in upper atmospheric and meteorological research and particularly with those dealing with observations of atmospheric density, pressure, temperature, cloud formations, etc.

To satisfy the growing and wide interest an effort has been made to select a cross-section of the significant literature on meteorological satellites. Works relating to other than meteorological applications of satellites have been reserved for publication in another bibliography.

The material has been arranged alphabetically by author. A Subject Outline and a Geographical Outline have been provided in order to facilitate location of specific subjects and areas.

This bibliography has been prepared for and with partial support from the National Aeronautics and Space Administration which is not only interested in this subject, but has contributed greatly to the output of scientific literature in this field during the past 2 or 3 years. In the next few years an even greater volume of such material will issue from this agency or result from weather satellites (such as Tiros I and II) whose data will be used by scientists throughout the world.

OUTLINE OF CONTENTS

SUBJECT OUTLINE

General Works
Textbooks, 11J–14, –32
Monographs and Major Reports, 11J–23, –24, –28, –32, –35, –49, –100, –101, –109, –149, –153, –176, –179, –185, –195, –198
Bibliographies, 11J–14, –15, –30, –31, –35, –46, –100, –103, –107, –109, –131, –132, –153, –155, –174, –176
Congresses and Conferences, 11J–113, –119, –146

Satellites
U. S. satellites, 11J–29, –64, –68, –92, –134, –184, –186
1958 Alpha (Explorer I), 11J–4, –7, –66, –115, –163, –183
1958 Beta (Vanguard I), 11J–9, –10, –37, –66, –112, –130, –159
1958 Epsilon (Explorer IV), 11J–142
1958 Gamma (Explorer III), 11J–7, –9, –159
1959 Alpha (Vanguard II), 11J–47
1959 Iota (Explorer VII), 11J–6
1960 Beta (Tiros I), 11J–12, –43, –53, –86, –124, –147, –166, –167, –192, –200, –201
Geophysical satellites, 11J–29
MOUSE (minimum orbital unmanned satellite of the earth), 11J–55, –152, –187
Soviet satellites, 11J–8, –92, –94, –96, –125, –127, –128, –131, –134, –143, –148, –165, –172
1957 Alpha (Sputnik I), 11J–3, –8, –38, –42, –98, –126, –133, –137, –138, –139, –158, –163, –195
1957 Beta (Sputnik II), 11J–38, –60, –114, –126, –133, –195
1958 Delta (Sputnik III), 11J–13, –18, –27, –39, –60, –82, –95, –107, –130
Weather satellites, 11J–12, –43, –51, –54, –56, –110, –166, –167, –189, –190, –191, –192, –199, –200, –201

Instruments
Accelerometer, 11J–81
Electronic equipment, 11J–21

Geiger counter, 11J–181
Ionization chamber, 11J–181
Manometer, 11J–30, –97, –107
Photocamera, 11J–102
Photocells, 11J–47
Photoelectric telescopes, 11J–181
Photometer, 11J–88
Photodetector, 11J–168
Photomultiplier, 11J–96
Photon counter, 11J–26, –27, –117
Spectrometer, 11J–95, –96
Television equipment, 11J–34, –35, –47, –51, –102, –166
Transmitter, 11J–37, –112

Observational Methods and Techniques
Albedo measurement technique, 11J–40, –48, –52
Air resistance, 11J–19
Beacon system, 11J–110
Photography, 11J–2, –11, –12, –40, –43, –52, –147, –167, –178, –192, –200, –201
Radar, 11J–110
Radio, 11J–127, –131, –134, –137
Satellite acceleration, 11J–74, –75, –76, –196
Satellite deceleration, 11J–98, –132
Satellite orbital elements, 11J–18, –38, –39, –60, –61, –62, –63, –71, –90, –91, –93, –94, –98, –141, –159, –162
Television, 11J–34, –35, –47, –50, –51, –102, –166
Visual (Optical), 11J–127, –131, –133

Elements Measured
Upper atmosphere structure
Exosphere, 11J–131, –157
Thermosphere, 11J–15
Density, 11J–1, –7, –18, –30, –38, –39, –40, –41, –42, –59, –61, –62, –63, –66, –70, –71, –76, –80, –81, –90, –98, –107, –121, –122, –126, –128, –130, –137, –138, –139, –140, –141, –142, –143, –148, –150, –159, –160, –161, –182, –195, –196
models, 11J–75, –104, –161, –162, –163, –164, –165
solar effects, 11J–93
synoptic, 11J–81
variation, 11J–60, –74, –89, –91, –92, –93, –94, –104, –129, –134
Pressure, 11J–30, –133, –150
Temperature, 11J–15, –37, –41, –79, –80, –88, –121
variation, 11J–128, –134, –141, –172
Upper atmosphere composition
Hydrogen distribution, 11J–26
Nitrogen dissociation and recombination, 11J–122
Oxygen dissociation and recombination, 11J–122
Ozone distribution, 11J–158, –193
Upper atmosphere properties, 11J–96, –129
Radiation, 11J–13, –99
Infrared, 11J–12, –58, –69, –194
Lyman alpha, 11J–26
Solar, 11J–40, –52, –55, –74, –104
Ultraviolet, 11J–40, –103
Cosmic, 11J–172
Atmospheric disturbances, 11J–34
Winds, 11J–49
Storms, 11J–154, –176, –190, –191, –200, –201
Clouds, 11J–47, –49, –57, –105, –147, –166, –187, –189, –190, –191, –192
Patterns, 11J–34, –47, –49
Velocity, 11J–2
Albedo, 11J–52, –153, –168
Various Elements, 11J–16, –17, –22, –23, –33, –36, –52, –54, –57, –65, –73, –84, –87, –95, –105, –111, –125, –127, –132, –135, –152, –155, –173, –177, –180, –197

Miscellaneous
Atmospheric model, 11J–109
IGY satellite program, 11J–4, –5, –9, –25, –37, –44, –64, –73, –85, –106, –116, –117, –118, –119, –156, –169
Satellite programs, 11J–31, –34, –35, –52
Satellite instrumentation, 11J–16, –17, –21, –31, –53, –54, –82, –111, –114, –123, –133, –147, –155, –156, –181
Satellite observatories, 11J–4, –11, –22, –34, –149, –152, –153, –155, –170
Satellite reflectivity, 11J–151
Satellite temperature, 11J–55
Satellite visibility, 11J–1
NASA Space Science Program, 11J–72, –171, –175
Space research, 11J–20, –120, –144, –145, –171, –188
Project Tiros, 11J–47
Project Vanguard, 11J–23, –24, –37, –44, –46, –64, –65, –106, –116
Weather forecasting, 11J–25, –35, –105, –108, –197, –198

GEOGRAPHICAL OUTLINE

Hemispheres
Northern Hemisphere, 11J–142
Southern Hemisphere, 11J–142

Australia
Brisbane, 11J–12

Europe, 11J–12
Czechoslovakia, 11J–169
Switzerland
Geneva, 11J–113, –146
United Kingdom, 11J–58
U.S.S.R., 11J–136
Moscow, 11J–119

North America
Caribbean Sea
Swan Island, 11J–58
United States, 11J–58, –101
Florida
Cape Canaveral, 11J–183

Massachusetts
Bedford, 11J–131
Cambridge, 11J–131
Nebraska, 11J–12
New Jersey
Ft. Monmouth, 11J–12
Washington, D. C., 11J–131

Oceans, Seas and Islands
Mediterranean, 11J–12
North Pacific Ocean
Hawaiian Islands
Kaena Point, 11J–12
Pacific Ocean
Eastern Pacific, 11J–201

11J–1 551.507.362.2

Abbott, W. N. (*Geophysical Institute, College, Alaska*), **Seasonal illumination of a circumpolar earth satellite at its extreme-latitude orbit point.** *Nature*, London, 182(4636):651–652, Sept. 6, **1958.** 3 figs., 2 tables, eqs. **DWB**—Insolation of an orbiting satellite as related to optical tracking for measurements of air densities is treated in this brief theoretical discussion in which increased illumination of the arc as a function of atmospheric refraction is excluded. Graphical and tabular results of the study are presented. *Subject Headings:* **1. Satellite density measurements 2. Satellite visibility.**—*W.N.*

11J–2 551.576.5:551.507.362.2

Aiken, J. J. and Widger, W. K., Jr. (*both, Geophysics Research Directorate*), **On the possibility of measuring cloud velocities from a satellite.** *U. S. Air Force. Cambridge Research Center, GRD Research Notes*, No. 36:47–62, June **1960.** 6 figs., numerous eqs. **DWB**—The theoretical possibility of using the satellite photographs of cloud movements for determining the speed of a cloud to an accuracy of ±10 mph is discussed. Three cases are discussed. Cases I and II, which use ground distances and angle measurement, respectively, in determining cloud velocity, assume that the cloud is moving in the same vertical plane as the satellite orbit. Case III represents the occurrence when the cloud is not moving in the plane of the satellite orbit. The general conclusion drawn is that the degree of accuracy of measurement necessary to measure the velocity of a cloud within ±10 mph is not significant for practical application, and, unless some new method of measurement can be devised, the outlook for measuring cloud speed by the satellite methods will remain bleak. *Subject Headings:* **1. Cloud velocity 2. Cloud photography 3. Satellite observations.**—*I.S.* Ⓢ

11J–3 551.510.535:551.507.362.2

Al'pert, Ia. L.; Dobriakova, F. F. et al., **O nekotorykh rezul'tatakh opredeleniia elektronnoĭ kontsentratsii vneshneĭ oblasti ionosfery po nabliudeniiam za radiosignalami pervogo sputnika Zemli.** [Some results of determining the electron concentration of the outer region of the ionosphere from observations of the radio signals of the first earth satellite.] *Uspekhi Fizicheskikh Nauk*, Moscow, 65(2):161–174, **1958.** 9 figs., 28 eqs. **DLC**—Sputnik I broadcast at 40 Mc/s allowing calculations to be made of the electron concentration in the layers of the ionosphere by measuring the time of rising and setting of the satellite radio beam. Results of observations made at 6 places on Oct. 5, 6 and 7, 1957 are tabulated and analyzed. Methods of determining the radio paths in the ionosphere are reviewed from theoretical and practical viewpoints; then the details of calculating the distance of the object at the time of radio rising and setting are presented mathematically and graphically; followed by results of such analysis and, finally, a discussion and analysis of the determined electron concentration of the outer ionized layers and density of interplanetary gas (320 to 2450 km height). *Subject Headings:* **1. Electron concentration of outer ionosphere 2. Satellite ionospheric observations 3. Soviet satellite, 1957 Alpha (Sputnik I). I. Chudesenko, E. F. II. Shapiro, B. S.**—*M.R.*

11J–4 551.507.362.2:551.506.22

First US-IGY Satellite. *American Geophysical Union, Transactions*, 39(2):353–355, April **1958.** 2 figs. **DWB, DLC**—On Jan. 31, 1958 at 10:48 EST the first US-IGY satellite, 1958α, was launched from Cape Canaveral, Fla. The U. S. Army Ballistic Missile Agency and the Jet Propulsion Laboratory of the California Institute of Technology worked together to develop the launching vessel which was a four-stage modified Jupiter-C rocket. The rocket's electric motors were used to spin the upper stages at 450 rpm before take-off. After take-off the spin was increased to 700 rpm. The over-all length of the composite vehicle was 823.3 in. Its orbital speed increased to approximately 18,000 mph. Its final stage carried the scientific instrumentation to measure the total cosmic ray intensity, density of meteoric matter in the satellite's orbit, and to measure temperature both within and at the skin of the satellite. Minitrack and Microlock stations in different parts of the world are engaged in tracking the 1958α. Discussions on the observations and the orbit are contained in the paper. (*Same item as* 10.9-44, Sept. 1959, *Met. Abstr.*) *Subject Headings:* **1. IGY satellite program 2. Satellite observatories.**—*N.N.*

11J–5 551.506.22:551.507.362

IGY Rocket and Satellite Report Series. *American Geophysical Union, Transactions*, 39(4):786, Aug. 1958. **DWB, DLC**—Data derived from results of experiments and observations conducted in connection with the IGY Rocket and Satellite Program are being issued in two series of reports published by the IGY World Data Center A subcenter for Rockets and Satellites. The two series are (a) IGY Satellite Report Series, and (2) IGY Rocket Report Series. Information is given as to the price, ordering, payment, and to special discounts for libraries. Reports already published in the Satellite Series are listed. *Subject Headings:* **1. IGY Satellite Report 2. IGY Rocket Report 3. Serial publications.**—*E.K.*

11J–6 551.506.22:551.507.362.2

IGY Satellite 1959 Iota. *American Geophysical Union, Transactions*, 40(4):401–405, Dec. 1959. 2 figs. **DWB, DLC**—1959 Iota (Explorer VII) was launched on Oct. 13, 1959, as a contribution to the IGY and to its successor, International Geophysical Cooperation 1959. Scientific experiments include measurements of the earth's radiation balance, heavy primary cosmic rays, solar ultraviolet radiation, X-radiation, etc. The article gives information about the launching, characteristics, experiments and instrumentation, radio equipment, tracking and orbital data of the satellite. *Subject Headings:* **1. IGY program 2. U. S. satellite, 1959 Iota (Explorer VII)**.—*E.K.* Ⓢ

11J–7 551.506:551.507.362.2

***Preliminary reports: satellites 1958 Alpha and 1958 Gamma.** *American Geophysical Union, Transactions*, 39(4):767–771, Aug. 1958. 3 figs., table, 8 refs. **DWB, DLC**—Preliminary reports on data gathered by US-IGY satellites 1958 Alpha and 1958 Gamma were made to members of the National Academy of Sciences, the American Physical Society, and the Washington scientific community at a special meeting held May 1, 1958, at the National Academy of Sciences in Washington, D. C. The reports discussed high intensity radiation, micrometeorites, satellite temperatures, and atmospheric densities. *Subject Headings:* **2. Satellite data 2. Upper atmosphere densities 3. U. S. satellites.**—*E.K.*

11J–8 551.507.362.2(47)

Preliminary summary of USSR satellite reports. *American Geophysical Union, Transactions*, 38(6):991–993, Dec. **1957. DWB**—This summary is "based upon a composite of unofficial reports as of Oct. 26, 1957, on the first USSR satellite to be placed in orbit. The reports were gathered from press coverage of Radio Moscow, direct reports to the USNC-IGY, and public reports of various radio and visual tracking activities. The material covers the launching, satellite characteristics, instrumentation, observations and orbit. *Subject Headings:* **1. Soviet satellite, 1957 Alpha 2. Satellite tracking.**

11J–9 551.506.22:551.507.362.2

Second and third US-IGY satellites. *American Geophysical Union, Transactions*, 39(3):587–590, June **1958.** 2 figs. **DWB, DLC**—The second US-IGY satellite, 1958β was launched from Cape Canaveral, Fla., at 7:16 a.m. EST on March 17, 1958 and the third satellite, 1958γ, was launched from Cape Canaveral, at 12:38 p.m. EST, March 26, 1958. The launching, satellite characteristics, instrumentation, and orbit of each are described. *Subject Headings:* **1. U. S. satellite, 1958 Beta (Vanguard I) 2. U. S. satellite, 1958 Gamma (Explorer III).**—*N.N.*

11J–10 551.507.362.2

Arnowitz, Leonard, **In the vanguard of space flight.** *Flying*, N. Y., 61(2):51–53, Feb. **1957.** photos. **DWB**—Facts and opinions regarding the planned firing of the Vanguard satellite vehicle accompanied by photos and drawings. *Subject Headings:* **1. Project Vanguard 2. U. S. satellite, 1958 Beta (Vanguard I).**—*W.N.*

11J–11 551.507.362.2

Aujeszky, László, **A "mesterséges hold" létesítésének meteorológiai kérdései.** [Meteorological aspects of artificial satellites.] *Időjárás*, Budapest, 59(5):312–313, Sept./Oct. **1955. DLC**—The practical meteorological value of an instrument-carrying artificial satellite traveling around the earth at some 400 km altitude for several days or weeks is believed to be considerable in the field of radiation measurement. The author does not believe, however, that cloud photographs from such a height (as suggested by I. Almár, Sept. 13, 1955) would be likely to improve existing forecasting techniques. Such photographs would only duplicate information now provided on synoptic weather maps. Moreover the future state of cloudiness must be forecast from the physical state of the atmosphere rather than from prevailing cloud conditions. (*Same item as* 7.10–45, Oct. 1956, *Met. Abstr.*) *Subject Heading:* **1. Satellite observatories**—*G.T.*

11J–12 551.507.362.2:778.3

Baroni, A., **Il satellite meteorologico "Tiros I"** [The weather satellite "Tiros I."] *Rivista di Meteorologia Aeronautica*, Rome, 2(3):21–30, July/Sept. **1960.** 9 figs. Italian, French and German summaries p. 21. **DLC**—A short summary of the chief features of the satellite Tiros I is presented. Its range of possible uses in the operative stage is considered in the light of the practical results of its first activity period. The satellite, provided with an instrument sensible to infrared radiation, makes it possible to establish the surface temperature of the earth and to obtain photographs at night with great accuracy. Illustrative matter includes: photographs showing the 122 kg drum-shaped satellite one meter in diameter and of 50 cm in height, with its upper surface and sides covered with 9300 solar cells, and its four transmitting antennas; installation of its wide angular telecamera; the complex antenna at Ft. Monmouth, N. J., similar to the one at Kaena Point, Hawaii; twenty-one instruments as they are mounted inside and partly on the surface of the drum; a double series of photographic strips received over the European Mediterranean during the satellites 14th and 15th orbiting April 2, 1960; the cloud system of a typhoon 1600 km east of Brisbane as photographed during the 135th orbit; the clouds associated with a perturbation advancing over Nebraska along with a meteorological chart indicating the position of the orbital path and camera direction of the satellite on April 1, 1960, of its 5th orbit when the photos were taken from an altitude of 720 km. A map illustrates the first four orbital courses around the earth. The results of the meteorological analyses of the above mentioned photograph strips of April 2, 1960 are presented on a weather chart of Europe. *Subject Headings:* **1. Weather satellites 2. U. S. satellite, 1960 Beta (Tiros I) 3. Satellite instrumentation 4. Photographic observations.**—*O.T.* Ⓢ

11J–13 551.507.362.2:621.398:551.521

Basler, R. P.; Dewitt, R. N. and Reid, G. C. (*all, Univ. of Alaska*), **Radiation information from 1958δ_2.** *Journal of Geophysical Research*, Wash., D. C., 65(4):1135–1138, April **1960.** 4 figs., 3 refs. **DLC**—The telemetered radiation information from the satellite 1958δ_2 (Sputnik III) has been analyzed for 62 separate passes recorded in College, Alaska. The data indicate a dependence of radiation intensity on altitude in the range 250 to 500 km. Both the high- and the low-energy components apparently contribute to the over-all increase of intensity with altitude, but the presence of a continuous afterglow in the scintillating crystal prevented detailed interpretation of the results. *Subject Headings:* **1. Radiation measurements 2. Soviet satellite, 1958 Delta (Sputnik III).**—*Authors' abstract.* Ⓢ

11J–14 551.507.362.2:629.19:551.501.7(02)

†Bates, David Robert (*ed.*), **Space research and exploration.** (rev. enl. ed.) N. Y., William Sloane, **1958.** 287 p. 21 figs., 21 tables, bibliogs., eqs. **DWB** (629.1388 V329sp). An earlier **1957** ed, ed. by D. R. Bates and Patrick Moore, issued London, Eyre and Spottiswoode, **1957.** 224 p. 24 figs., 26 tables, refs. at end of each ch., eqs. (*See* 9.1–2, Jan. 1958, *MAB*)—**DLC** (TL790. B3 1957)—A series of articles on rockets, space flight, cosmic ray and meteor hazards outside the atmosphere, earth satellites, manned satellites, space navigation, medical and biological problems, and conditions on the moon and planets. Each article is written by a British expert in the field: D. R. Bates, Patrick Moore, A. C. Clarke, L. R. Shepherd, M. W. Ovenden, H. S. W. Massey and others. Articles are somewhat technical in nature, and are supplemented by charts, tables, drawings and reference lists. (*Same item as* 10.6–4, June 1959, *Met. Abstr.*) *Subject Heading:* **1. Space flight textbooks.**—*M.R.*

11J–15 551.507.362:551.524.77:551.510.536

†Bates, D. R. (*Queen's Univ., Belfast*), **Some problems concerning the terrestrial atmosphere above about the 100 km level.** *Royal Society of London, Proceedings, Ser. A.*, 253(1275):451–462. Dec. **29, 1959.** 2 figs., table, 57 refs., 22 eqs. **DWB, DLC**—Consideration is given to the significance of recent rocket and satellite studies relating to the structure of the thermosphere. It is shown that unless hydrogen atoms are being captured very rapidly from interplanetary space they must be very rare indeed at the base of the exosphere. Stress is laid on the importance of the steepness of the temperature gradient above the *E* layer in connection with the thermal economy. Though no final conclusion is reached, it is thought that the view that the ionizing radiation from the sun is the main source of heat is more attractive than any alternative view yet put forward. An analytic model of the thermosphere is described in the appendix. *Subject Headings:* **1. Thermosphere 2. Upper air temperature gradients 3. Satellites research 4. Rocket research.**—*Author's abstract.* Ⓢ

11J–16 551.507.362.2

Berkner, Lloyd V. (*Associated Universities, Inc. U. S.*), **The instrumented earth satellite.** *Science and Culture* Calcutta, 22(10):553–554, April **1957. DWB, DLC**—Seven major experiments planned for the U. S. earth satellite are listed and those plans for radioastronomical observations, micro-

meteorite and ionospheric studies are explained in more detail. *Subject Heading:* **1. Satellite instrumentation.**—*M.R.*

11J–17 551.507.362.2

Berlage, Hendrik P., **Some reflections of a geophysicist while the astronauts gather.** *Hemel en Dampkring*, The Hague, 56(7–8):132/134, July/Aug. **1958.** fig. **DWB, DLC**—The geophysicist, Berlage, asks how an artificial satellite can enrich our knowledge of the earth. He mentions what we can learn by simply following the motion of the satellite. The instruments carried by the satellite make it possible 1) to measure densities as low as 10^{-16} grams per cm^3, values such as probably prevail at levels of approximately 400 km; 2) to deduce the spectral composition of solar radiation; 3) to make measurements of the earth's magnetic field at very high levels and 4) to compute the atmospheric composition. *Subject Heading:* **1. Satellite observatories.**—*A.V.*

11J–18 551.507.362.2:551.510.53:551.510.3

Bochniček, Z. V. (*Bratislava, Czechoslovakia*), **Profile of upper-atmosphere air density at the height 180–212 km. derived from the orbit of Sputnik III.** *Nature*, London, 186(4723):460–461, May 7, **1960.** 2 figs., 2 refs., 3 eqs. **DWB**—Air density can be determined from observed changes in size and shape of the satellite orbit when the drag coefficient of the satellite is known. To get the profile of upper atmosphere air density at a height of 180–212 km, the orbital elements and their changes for the third Soviet satellite, $1958\delta_2$, were analyzed during the time interval March 11, 1959 to Jan. 5, 1960. The result of the analysis is shown in figs. It is noticeable that the scale height was 2–3 times greater than that observed from various theoretical models of the upper atmosphere and that no seasonal effect was detectable during the observation period although other artificial satellites with higher perigees were strongly influenced by changes of air density of long duration. *Subject Headings:* **1. Upper atmosphere densities 2. Soviet satellite, 1958 Delta (Sputnik III).**—*E.K.* Ⓢ

11J–19 551.507.362.2:551.510.536

Bosanquet, C. H., **Scale height of the upper atmosphere.** *Nature*, London, 182(4641):1010–1011, Oct. 11, **1958.** ref., 14 eqs. **DWB**—The effect of air resistance on the orbits of man-made satellites are computed by formulas valid for a spherical earth. Since ellipticity is not at all negligible it is here introduced with minimum complication. *Subject Headings:* **1. Upper atmosphere properties 2. Exosphere 3. Satellite orbits.**—*W.N.*

11J–20 551.507.362:621.19:061.3

Boyd, R. L. F. (*Dept. Physics, Univ. Coll., London*), **Space research.** *Nature*, London, 183(4658):361–364, Feb. 7, **1959. DLC**—Russian and American scientific achievements in geophysical rockets and earth satellites, before and during the IGY, are reviewed in a meeting arranged by the Royal Society and held in London on November 12–13, 1958. Several authorities in the various fields describe some scientific techniques, the associated problems and also outline future explorations of the space. Cooperating countries, their efforts and contributions during the IGY are given. The Russian delegation was absent. *Subject Headings:* **1. Space research 2. Rockets 3. Satellites.**—*N.N.*—Ⓢ

11J–21 621.396.946:621.317.7

Boyd, R. L. E. (*Dept. of Physics, Univ. College London*), **Electronic instruments in space-research vehicles.** *Institution of Electrical Engineers, London, Journal*, 5(56):457–463, Aug. **1959.** 6 figs., table. **DLC**—The most important of the special environmental conditions for electronic instruments in satellites is temperature. This is closely followed in significance by vibration and acceleration hazards and by weightlessness. None of these conditions is normally serious for miniature equipment. Miniaturization is as important in connection with power saving and strength as in space and weight economy. The provision of electrical power is a major, if not limiting, problem for much satellite experimentation. Types of power source available are discussed, as is the ancillary equipment normally required in space vehicles for data recovery, position determination, time-keeping and so on. Also briefly mentioned are the many types of sensing device with which basic measurements are made. (*Same item as* 11.5–179, May 1960, *Met. Abstr.*) *Subject Headings:* **1. Electronic equipment 2. Satellite instrumentation.**—*Author's abstract.*

11J—22 551.509.6

Brundidge, Harry T., **The weather is changing.** *American Mercury*, N. Y., 90(374):17–19, March **1955. DWB**—A brief popular account of the effects of atom bombs and rain makers vs. natural climatic changes and possibility of control through regulation of solar energy by dust or CO_2 control, and of observation from an asteroid about 400 mi from earth. (*Same item as* 7.4–124, April 1956, *Met. Abstr.*) *Subject Headings:* **1. Weather control 2. Satellite observatories.**—*M.R.*

11J–23 551.507.362.2

Buedeler, Werner, **Operation Vanguard: earth satellite.** Transl. by A. L. Helm [from the orig. German **Projekt Vorhut**]. London, Burke, **1957.** 128 p. figs., photos. **DWB** (629.1388 B928op) —A popular and somewhat less than prophetic account of the Vanguard project which was to launch the first man-made satellite into space during IGY. The various chapters discuss in glowing terms the beginning of the new "space age," the history of rocketry, the various aspects of artificial satellites, their scientific uses, their practical value, future space platforms and more complicated satellites and, finally, "man and space flight." The illustrations of the U. S. Navy's Vanguard satellites and rockets, etc. are excellent. The book was issued before Sputnik, but made mention of Soviet interest in such developments. (*Same item as* 10.3–34, March 1959, *Met. Abstr.*) *Subject Headings:* **1. Project Vanguard 2. Satellite observatories.**—*M.R.*

11J–24 551.507.362.2

Caidin, Martin, **Vanguard! the story of America's scientific satellite program.** N. Y., Dutton, **1957.** 288 p. figs., photos. **DWB** (629.1388 C133fa)—A popular technical book describing the U. S. earth satellite program (Project Vanguard), and the launching facilities, tracking station and equipment, the launching techniques, the atmosphere and its structure, meteors, auroras, the V-2, Aerobee, Atlas and the several stage components of the Vanguard, each described and illustrated with excellent photos and drawings in separate chapters. (*Same item as* 10.9–27, Sept. 1959, *Met. Abstr.*) *Subject Headings:* **1. Project Vanguard 2. Rocket development 3. Earth's atmosphere.**—*M.R.*

11J–25 551.507.362.2:551.506.22

Carter, L. J., **The artificial satellite.** *British Interplanetary Society, Journal*, 14(6):297–299, Nov./Dec. **1955. DLC**—An editorial summarizing plans for the 12 satellites to be launched by the U. S. during IGY, and their possible orbits and ultimate value in weather forecasting, etc. (*Same item as* 9.7–69, July 1958, *Met. Abstr.*) *Subject Headings:* **1. Artificial satellites 2. IGY satellite program 3. Weather forecasting.**—*M.R.*

11J–26 551.508.21:551.521:551.507.362.2

Chubb, T. A.; Friedman, H. and Kupperian, J. (*all, U. S. Naval Res. Lab., Wash., D. C.*), **A satellite experiment to determine the distribution of hydrogen in space.** (In: Van Allen, James A. (*ed.*), **Scientific uses of earth satellites.** Ann Arbor, Univ. of Michigan Press, **1956.** p. 152–156. 3 figs., 2 refs.) **DWB, DLC**—A relatively insensitive photon counter could be used to measure 1216 A radiation from sun, but more sensitive photon counters can be used to measure the background scattered Lyman alpha radiation and that due to recombination of H atoms into H_2 molecules after being dissociated by shorter solar UV and X-rays during solar flares. The two types of background radiation can be distinguished due to lag in latter (recombination) radiation compared with scattered Lyman alpha radiation. Electronics and aspect system are described and illustrated. Measurements can be made over 80% of orbit. *Subject Headings:* **1. Lyman alpha radiation measurements 2. Satellite radiation equipment.**—*M.R.*

11J–27 551.507.362.2:551.521.67

Chudakov, A. E., **Izuchenie fotonov pri pomoshchi tret'ego iskusstvennogo sputnika Zemli.** [The study of photons by means of the third Soviet artificial earth satellite.] *Priroda*, Moscow, No. 12:88–90, Dec. **1958.** 3 figs., table. **DLC**—The third Soviet artificial earth satellite was provided with a luminescent counter for recording photons. It consisted of a cylindrical Sodium Iodide crystal 40 × 40 mm in size and a photomultiplier with a photo cathod of 45 mm. The impulses arising in the outlet of the photomultiplier were intensified by semiconductor intensifiers and transmitted in a double manner. At the outlet of the counting circuits a relay was placed and the position of its contacts was transmitted by radio. Also there were two other relays which transmitted data on total ionization. Preliminary analysis of the data shows that in the region of increased counts there was only a slight increase in ionization. The energy of photons corresponding to an increased count was computed as 100 kev. The origin of these photons may be explained by drag radiation arising during the bombardment of the satellite by electrons with an energy of 100 kev. The currents of electrons with this energy, existing only at the poles, is estimated as $\frac{10^3 \text{ particles}}{\text{cm}^2/\text{sec step}}$. The intensity of photons from the sun did not appear to be influenced by solar flares. *Subject Headings:* **1. Solar radiation measurements 2. Satellite instrumentation. 3. Soviet satellite. 1958 Delta (Sputnik III).**—*I.L.D.*

11J–28 551.507.362.2:629.19(02)

Soviet writings on earth satellites and space travel. N. Y., Citadel Press, **1958.** 253 p. 41 figs., tables. **DWB, DLC**—The history of Russian development of astronautics and rocketry (since 1924) leading up to the successful launching of the first Sputnik on Oct.4 , 1957 is recounted, followed

by general aspects of rockets, satellites and space travel and uses thereof. A Joint Committee on Space Travel was organized in the Astronomical Council of the Akademiia Nauk in 1954 and an Astronautical Society at the Central Air Club in Moscow (also 1954). The International Astronautical Federation coordinates societies of >20 countries. Pt. II includes a number of articles by or interviews with Soviet scientists after Sputniks I, II or III were launched, and covers many aspects of satellite observations and applications (military, communications, optical, weather (Obukhov), astronomical, solar, travel to moon or planets, biological problems, navigation, power, etc. (*Same item as* 11.1-110, Jan. 1960, *Met. Abstr.*) *Subject Headings:* **1. Soviet satellites 2. Astronautics I. Obukhov, Alex.**—*M.R.*

11J–29 551.590.21:551.507.362.2

Clark, John F. (*NASA*), **Geophysical research using artificial earth satellites.** *Institute of the Aeronautical Sciences, IAS Paper*, No. 6050, **1960.** 14(?) p. Mimeo. **DWB** (M:629.13 159pa)—The sun influences strongly the entire gamut of human activities. Its radiations drive the world-wide atmospheric circulations, and the outbursts of its shorter-wave radiations and particle streams may influence corresponding world-wide weather patterns. Consequently, the fundamental question to be answered by geophysical satellite research is: What is the nature of the control exerted by the sun over events on the earth? Significant progress is being made toward answering this question, particularly in satellite studies of the radiation belts, the geomagnetic field, and atmospheric and ionospheric structure. The geodetic figure of the earth is now known more precisely through satellite orbital measurements. Over the next two years, U. S. geophysical satellites are planned to be launched at the rate of one every two to three months, using the Juno II, Delta, and Scout vehicle systems. Earth-sun relationships in atmospheric, ionospheric, and energetic particle physics will be emphasized. *Subject Headings:* **1. Geophysical research 2. Satellite observations. 3. U. S. satellites.**—*Author's abstract.* Ⓢ

11J–30 551.510.53:551.507.362.2

†Danilin, B. S.; Mikhenevich, V. V.; Repnev, A. I. and Shvidkovskiĭ, E. G., **Zadacha izmereniia davleniia i plotnosti vysokikh sloev atmosfery s pomoshch'iu iskusstvennogo sputnika zemli.** [Problem of the measurement of pressure and density of the upper layers of the atmosphere with the aid of an artificial earth satellite.] *Uspekhi Fizicheskikh Nauk*, Moscow, 63(1):205–225, Sept. **1957.** 10 figs., 4 tables, 34 refs., 51 eqs. **DLC** Transl. into English issued in Massachusetts Institute of Technology. Lincoln Lab., **Collection of Soviet papers on earth satellites.** Issued **1957**; reissued **1958.** p. 17–48. **DWB** (629.1388 M41400)—The physical aspects of measuring pressure and density in the upper layers of the atmosphere are considered. It is assumed that the manometer employed will also measure ionization, as well as pressure and density, and is to be carried by an artificial earth satellite. *Subject Headings:* **1. Upper atmosphere pressure measurements 2. Upper atmosphere density measurements 3. Satellites.**—*Physics Abstracts*, 6532, 1958.

11J–31 551.507.362.2:629.19

deBey, L. G. (*Ballistic Research Labs., Aberdeen Proving Ground, Md.*), **Systems design considerations for satellite instrumentation.** (In: Van Allen, James A. (*ed.*), **Scientific uses of earth satellites.** Ann Arbor, Univ. of Michigan Press, **1956.** p. 49–54. ref.) **DWB**—The military services have proposed a number of satellite programs. Each has objectives tailored to the interests of the sponsoring agency. The magnitude of any satellite program warrants careful consideration of the program output in terms of the number of scientifically useful data obtained. To achieve maximum output, compatible with the missile-system limitations, in turn requires a careful choice of observing methods. The types of observations required for different programs are discussed, as are factors affecting choice of observing systems, their locations and technical specifications. The importance of adhering to the philosophy of redundancy in observing methods is stressed. An array of instrumentation systems is proposed as being the minimum that could be expected to yield successful results in the first satellite firings. (*Same item as* 9.1-92, Jan. 1958, *Met. Abstr.*) *Subject Headings:* **1. Satellite programs 2. Satellite instrumentation.**—*Author's abstract.*

11J–32 551.5:531.5(02) 551.501.81:531.5:358.1

Denisov, Iuriĭ Stepanovich, **Radiotekhnika v artilleriĭskoĭ meteorologii.** [Radio techniques in artillery meteorology.] Moscow, Izdatvo Ministerstva Oborony Soiuza SSR, **1958.** 93 p. figs., tables, eqs. **DLC** (QC973.D45)—The basic principles and techniques of ballistic meteorology, radiosondes, use of radar, rockets and satellites in military (artillery) operations are set forth for the benefit of students, engineers, officers and other nonspecialists. Elements considered important are air temperature, pressure, humidity and wind, discussed on p. 6–16; effect of meteorological elements on flight of missiles, method of calculation and correction of trajectory, on p. 16–32; aerological measurements, on p. 32–62; radiosondes, on p. 62–75; radar tracking and sounding, on p. 76–89; and use of artificial earth satellites in meteorology, on p. 89–93. Several types of radiosondes:

Väisälä, Indian and Molchanov (U.S.S.R.) are described and illustrated. Many other instruments are treated in text and illustrated by schematic drawings, photographs or wiring diagrams. The general approach is engineering or instrumental. (*Same item as* 11.2–14, Feb. 1960, *Met. Abstr.*) *Subject Headings:* **1. Ballistic meteorology textbooks 2. Radiosondes 3. Satellite observatories 4. Radar meteorology 5. U.S.S.R.**—*M.R.*

11J–33 551.507.362.2:629.19 551.593

Dietze, Gerhard (*Gotha, Forschungsstelle*), **Die Bedeutung künstlicher Erdsatelliten für die atmosphärisch-optische Forschung.** [The importance of artificial earth satellites for atmospheric optical research.] *Zeitschrift für Meteorologie*, Berlin, 12(3):73–85, March **1958.** 6 figs., 4 tables, 15 refs., eqs. **DWB, DLC**—On the basis of geophysical and astronomical knowledge, the author examines the atmospheric optical measurements for which artificial earth satellites are being used and are to be used in the future. The earth satellite can serve either as a secondary light source as a result of reflection or as an instrument carrier. The three illumination zones of the cosmos near to the earth, namely, the earth shadow zone, the half-shadow zone and nuclear shadow zone are demonstrated geometrically. The relationship of the satellite to these zones and the effect of refraction, extinction and scattering upon these zones is discussed. The reflection of light by the satellite and the measurement of satellite brightness from the earth are discussed and equations, diagrams and tables are presented for measuring accurately the brightness of an artificial earth satellite. Equations and diagrams are presented giving the apparent brightness (stellar magnitude) of reflecting spherical satellites in a shadow-free space at a distance of 100 km, the brightness difference between a satellite at 100 km direct distance and a satellite at various heights above the earth and brightness loss as a result of extinction. The visibility of artificial earth satellites with the naked eye and telescope is considered as a physiological problem involving the distinction sensitivity of the eye for point targets. The use of the satellite as an instrument carrier to measure illumination intensity in shadow-free, in semi-shadow and in nuclear shadow space is discussed. *Subject Headings:* **1. Satellite optical absorption techniques 2. Atmospheric optics.**—*I.L.D.*

11J–34 551.507.362.2:551.515

Dryden, Warren A., **Useful satellite orbits for some high-altitude weather observations.** Florida. State Univ. Dept. of Meteorology, Contract AF 19(604)-1754, Scientific Report No. 1, Aug. 15, **1958.** 31 p. 11 figs., table, 2 refs., 9 eqs.—A discussion of the utilization of an artificial, unmanned satellite for the purpose of tracking atmospheric disturbances is presented. The disturbances are presumed to be recognized by cloud patterns viewed from high altitudes by means of a satellite-borne television camera which transmits an image to a telemetering station at the surface. Successive positions and, hence, the movements of these disturbed areas would be determined from the known position of the satellite. The usefulness of a satellite orbiting under the influence of its mutual gravitational attraction with the earth is presumed to be determined by the longitudinal displacements from day to day. The daily displacement is found to be a linear function of the elevation of the satellite. The direction of motion relative to the earth's equator also determines the usefulness of an orbit. As an example, it is found that a circular orbit with an elevation of 800 km is desirable for tracking middle-latitude disturbances, while the angle between the orbital plane and the earth's equatorial plane is less critical. The more easily attainable elliptic orbits are treated briefly. It is shown that the longitudinal displacements are not simply functions of the elevation—as in the circular case—but also of the speed at some point in the orbit such as perigee. (*Same item as* 10.8–93, Aug. 1959, *Met. Abstr.*) *Subject Headings:* **1. Satellite observatories 2. Atmospheric disturbance tracking from satellites.**—*Author's abstract.*

11J–35 551.507.362.2:551.509

†Dryden, Warren A. and Prosser, Norman E., **Optimum utilization of satellite observations in weather analysis and forecasting.** Florida. State Univ. Dept. of Meteorology, Contract AF 19(604)-1754, Final Report, Feb. 1, **1959.** 70 p. figs., photos, 82 refs., eqs.—A discussion of several types of weather observations, which might be obtained from a suitably-instrumented, artificial, earth satellite, is presented, and the possible uses to which these observations might be put in an attempt to improve the current status of short-range forecasting are considered. In a resume of a scientific report, (*for abstract see* 10.8–93, Aug. 1959, *Met. Abstr.*), some satellite orbits are discussed that appear to be useful in the high-level observation and tracking of tropospheric disturbances. It is found that the elevation of a circular orbit is the factor which determines its utility, while the elevation of and speed at some point (such as perigee) in an elliptic orbit are the critical factors. Another scientific report, (*for abstract see* 11J–34, Oct. 1960, *Met. Abstr.*), dealing with inferences of synoptic conditions from high-level rocket photographs is summarized. The results tend to indicate that the use of visual observations from satellites—as approximated by rocket photographs—will be useful when used in conjunction with other, more conventional observations. The work of other

investigators with regard to rocket photographs is discussed briefly; however, little additional information can be added to their results. In an attempt to determine the value of cloud observations for inferring the weather patterns in the atmosphere, three case studies of nephanalyses are presented. The first two deal with knowledge obtained from a nephanalysis alone, while the third study indicates that the major contribution—as was pointed out earlier—of the nephanalysis is to supplement conventional techniques of observation and analysis. The problem of the resolving power necessary to identify clouds from extremely high altitudes is discussed here. It is found that present-day television equipment is just sufficiently effective in recognizing some cloud types and patterns, but is not effective enough to recognize all the clouds necessary for a complete nephanalysis. *Subject Heading:* **1. Satellite uses in weather forecasting.**—*Authors' abstract.* Ⓢ

11J–36 551.5:629.19

†Due Rojo, Antonio (*Observatorio de Cartuja*), **El automatismo en meteorología.** [Automation in meteorology.] *Revista de Geofísica*, Madrid, 15(57):65–78, Jan./March **1956.** 11 refs. Also his: **Algunos problemas prácticos en los satélites artificiales.** [Some practical problems of artificial satellites.] *Ibid.*, 15(60):449–457, Oct./Dec. **1956.** 8 refs. **DWB**—A great number of ways in which automation will facilitate progress in meteorology along the 3 lines laid out by F. W. Reichelderfer, Chief of the U. S. W. B., namely in: 1) collection of data, 2) analysis of data and 3) dissemination of results obtained, are reviewed. Among these are the development of automatic weather stations, radiosondes, rockets, satellites, sferics recorders, radar observations of storms, ionospheric soundings by radio, radiation balance meters, numerical prediction studies of general circulation, hurricane or severe storm warning, facsimile transmission, punched card compilation, etc. Most examples given are from U. S. literature. In the supplementary paper, the author sums up (mostly from U. S. sources) recent developments and considerations connected with propulsion, guidance, scientific measurement and retrieval problems of artificial earth satellites and space ships. (*Same item as* 9.11–85, Nov. 1958, *Met. Abstr.*) *Subject Headings:* **1. Automation in meteorology 2. Progress in meteorology 3. Satellite development.**—*M.R., G.T.*

11J–37 551.507.362.2:551.506.22

Easton, R. L. and Votaw, M. J. (*both, U. S. Naval Res. Lab., Wash., D. C.*), **Vanguard I IGY satellite (1958 Beta).** *Review of Scientific Instruments*, N. Y., 30(2):70–75, Feb. **1959.** 11 figs., 2 tables, 3 refs. **DWB, DLC**—The instrumentation used, the measurements obtained, and the uses of the Vanguard I satellite are described. This satellite contains two transmitters, one powered by batteries for about three weeks and one powered by solar cells (still operating). From the transmitted frequencies, temperature information and rotation rates are obtained. The transmitted signals are also used to determine the satellite orbit. An approximate free orbital lifetime of 200 years is predicted. (*Same item as* 10.10–92, Oct. 1959, *Met. Abstr.*) *Subject Headings:* **1. IGY satellite program 2. Project Vanguard.**—*Authors' abstract.*

11J–38 551.507.362.2:521.312:551.510.53:551.510.3

El'iasberg, P. E., **Opredelenie plotnosti verkhneĭ atmosfery po vekovym izmeneniiam elementov orbit pervykh dvukh iskusstvennykh sputnikov zemli.** [Determination of the density of the upper atmosphere from the secular changes in the elements of the orbits of the first two artificial earth satellites.] *Iskusstvennye Sputniki Zemli*, Moscow, No. 1:21–24, **1958.** 3 tables, 4 refs., 5 eqs. **DLC.** Transl. into English in *Artificial Earth Satellites*, N. Y., Plenum Press, vol. 1:25–29, **1960. DWB**—The determination of the influence of atmospheric resistance on the secular variation of the elements of a satellite orbit is carried out by the equations:

$$\Delta T = -\frac{3\pi}{\sqrt{\mu}} b\rho_\pi a^{5/2} \cdot \frac{1+e}{1-e}\sqrt{1-e^2}\, f_0 \sqrt{\frac{2\pi}{\nu}}$$

$$\Delta e = -b\rho_\pi a(1+e)\sqrt{1-e^2}\, f_1 \sqrt{\frac{2\pi}{\nu}}$$

$$\Delta r_\pi = -b\rho_\pi a\sqrt{1-e^2}\, f' \frac{1}{2v}\sqrt{\frac{2\pi}{\nu}}$$

where ΔT, Δe, Δr_π = variation of the period of rotation T_1 of the eccentricity of the orbit e and of the perigee distance r_π for one rotation of the satellite about the earth; a = large semiaxis of the orbit, μ = product of the gravitational constant and mass of the earth, ρ_1 = density of the air at the point where the orbit is nearest the earth, $\nu = aek$ (coefficient determining the dependence of density ρ on height), and b = ballistic coefficient. From the long period variations of ΔT, Δe and $\Delta r\pi$ the values ρ_π and k characterizing the atmospheres in the perigee of the orbit can be computed. The

errors determining atmospheric density ρ for any height h_0 due to h_{min} depend upon errors in h_{min} ΔT, k and b, and are expressed by the equations:

$$\frac{\delta\rho\pi}{\rho} = k\delta h_{min}$$

$$\frac{\delta\rho\Delta T}{\rho} = \frac{\delta(\Delta T)}{\Delta T}$$

$$\frac{\delta\rho_b}{\rho} = \frac{\delta b}{b}$$

$$\frac{\delta\rho_k}{\rho} = \frac{1}{2} \cdot \frac{\delta b}{k}$$

The results of calculations of ρ on the basis of data from the first two Sputniks and the rocket carrier of Sputnik I are presented in a table. *Subject Headings:* **1. Upper atmosphere density measurements 2. Orbital elements 3. Soviet satellites.**—*I.L.D.*

11J–39 551.510.3:551.510.53:551.507.362.2

El'iasberg, P. E. and Iastrebov, V. D., **Opredelenie plotnosti verkhneĭ atmosfery po rezul'tatam nabliudeniĭ za poletom tret'ego sovetskogo iskusstvennogo sputnika Zemli.** [Determination of the density of the upper atmosphere according to flight observations of the third Soviet artificial earth satellite.] *Iskusstvennye Sputniki Zemli*, Moscow, No. 4:18–30, **1960.** fig., 6 tables, 4 refs., 26 eqs. **DLC**—Observations of satellite orbits provide one of the most reliable means of determining upper atmospheric density values. In this paper such values are derived from the most accurate measurements of orbital elements of the third Soviet artificial satellite. The method of calculation is described in detail and numerical values of the calculated elements are tabulated. The atmospheric density obtained for height of 246 km is 1.72×10^{-13} g/cm^3 for Sputnik III orbits. This compares with 1.73×10^{-13} g/cm^3 and 1.40×10^{-13} g/cm^3 as obtained with Sputnik II and Sputnik I with carrier rocket respectively. *Subject Headings:* **1. Upper atmosphere density measurements 2. Satellite data 3. Soviet satellite, 1958 Delta (Sputnik III).**—*G.T.* Ⓢ

11J–40 551.507.362.2

Faust, Heinrich, **Die Bedeutung des künstlichen Erdsatelliten für die Meteorologie.** [The importance of the artificial satellite for meteorology.] *Naturwissenschaftliche Rundschau*, 10(4):137–141, April **1957. DWB**—Artificial satellites will enable the atmosphere to be studied from above. First exact measurements of solar radiation and earth's albedo will be possible; the elliptical orbit and spiral descent will give information for different heights. Density and composition can be inferred, especially loss of water vapor to space. Variations of UV radiation are important for both short and long-range forecasting. Cloud distribution can be photographed by television cameras and new depressions recognized in areas with few stations. A regular satellite would save much money and might even prove a good capital investment. (*Same item as* 8.7–81, July 1957, *Met. Abstr.*) *Subject Heading:* **1. Satellite observatories.**—*C.E.P.B.*

11J–41 551.507.362.2

Faust, Heinrich, **Importance of artificial satellites for meteorology.** *Universitas*, Stuttgart, 2(1):93–94, **1958. DWB**—Density, temperature and composition ot the rare atmosphere at 200–300 mi are among the important information that can be gained better from a satellite slowly spiraling toward the earth than from one entirely outside the earth's atmosphere. Incident and reflected radiation, UV and cosmic rays during solar eruptions, effect of ozone layer, and other data which will materially aid in short and even in long range weather forecasting will be provided by a series of satellites whose economic benefits will far outweigh the cost, high though this is. (*Same item as* 10.7–91, July 1959, *Met. Abstr.*) *Subject Heading:* **1. Satellite observatories.**—*M.R.*

11J–42 551.507.36.2:551.510.3:551.510.53

Faust, Heinrich, **Die Luftdichte in grossen Höhen.** [Air density at high altitudes.] *Naturwissenschaftliche Rundschau*, Stuttgart, 11(7):274, July **1958. DWB, DLC**—On the basis of H. K. Paetzold's paper **"Einige Ergebnisse aus den Beobachtungen der ersten Russischen Erdsatelliten** [Some results of observations of the first Soviet satellites] (*Raketentechnik und Raumfahrtforschung*, No. 2, **1958**). (*For abstract see* 11J–127, this issue), the author discusses the latest measurements and estimates atmospheric density. In the calculation of atmospheric density the aerodynamic effects of the special shape of the satellite were neglected since in the relevant altitudes the mean

free path between atmospheric molecules exceeds one kilometer; also the collision between satellite and molecules were assumed to be inelastic. The atmospheric density along the paths of the satellite was found to be substantially greater than assumed hitherto. "According to rocket ascents made up to now the atmospheric density at 220 km was taken to be 1.2×10^{-13}/cm^3; but the observations of 1957α_2 give a value of 3.5×10^{-13}/cm^3. The slower decrease in density indicates, according to the barometric altitude formula, that the temperatures at 200 km must be around 1000°K, while previously they were assumed to be around 700°K. . . . Accordingly above 500 km temperatures of 2500°K probably prevail in contrast to the previously assumed temperatures of 1000°K." *Subject Headings:* **1. Upper atmosphere density measurements 2. Satellite observations 3. Soviet satellite 1957 Alpha (Sputnik I).**—*I.L.D.*

11J–43 551.507.362.2:551.576.2:778.3

Faust, Heinrich (*Offenbach*), **Wettersatellite Tiros I.** [Weather satellite Tiros I.] *Naturwissenschaftliche Rundschau*, Stuttgart, 13(6):227–228, June **1960.** 4 figs.—The purpose of the first weather satellite was to photograph cloud fields "from outside" at a distance of 700–750 km. Various data of its orbit, the functions of its delicate instruments, the registration of thermal radiation discontinuity between earth and firmament by its infrared horizon scanner and its response to commands received from stations on the earth are presented. An appraisal is made of the thousands of pictures already taken. It is hoped that measurements of radiation from the universe toward the earth will be provided by later weather satellites. The illustrations include pictures of clouds taken by the wide angle camera and a set of pictures from an altitude of 700 km. *Subject Headings:* **1. Cloud photography 2. Weather satellites 3. U. S. satellite, 1960 Beta (Tiros I).**—*O.T.*

11J–44 551.507.362.2:629.19 629.19

Fedorov, E. K. and Skuridin, G. A., **Rakety i iskusstvennye sputniki zemli v issledovaniiakh verkhneĭ atmosfery.** [Rockets and artificial earth satellites in upper atmospheric research.] *Akademiia Nauk SSSR, Vestnik*, 27(8):37–48, Aug. **1957.** 6 figs. **DLC**—Uses of rockets in upper atmos. research, problems presented in attempting to get back all of the needed data (an instrument container is brought back to earth by means of a parachute in the Soviet rocket, as shown in illustration). Over a hundred rockets are proposed (for IGY) to be launched from 3 points: 1) in Franz Josef land, 2) in mid-lat. European U.S.S.R. and 3) near Mirnyĭ station in Antarctica. The main part of the article describes and illustrates in detail the 3-stage rocket and the satellite proposed by the U. S. for Project Vanguard and the scientific experiments considered for this IGY project. (*Same item as* 9.5–54, May 1958, *Met. Abstr.*) *Subject Headings:* **1. Rocket research 2. Satellite research 3. Soviet rockets 4. Project Vanguard.**—*M.R.*

11J–45 551.507.362.2:551.510.53

Fedorov, E. K., **Issledovaniia verkhnikh sloev atmosfery pri pomoshchi raket i iskusstvennykh sputnikov zemli.** [Investigation of the upper atmospheric layers by means of rockets and artificial earth satellites.] *Priroda*, Moscow, 46(9):3–12, Sept. **1957.** 6 figs., ref. **DLC**—The greater possibilities of investigating the upper atmospheric layers by means of instruments installed in artificial earth satellites expected to be set in motion by the U.S.S.R. and U. S. shortly (during the current IGY)—and the superiority of data thus obtained over that of rockets, are discussed and reviewed. (*Same item as* 10.3-132, March 1959, *Met. Abstr.*) *Subject Headings:* **1. Satellite observations 2. Rocket observations 3. Upper atmosphere research.**—*A.M.P.*

11J–46 551.507.362(08)

†Franklin Institute, Philadelphia, **Earth satellites as research vehicles: proceedings of the Symposium held April 18, 1956 at the Institute.** Its *Monograph*, No. 2, June **1956.** Figs. and bibliogs. throughout. (For listing of contents, *see* Pt. III, p. 544, April 1957, *Met. Abstr.* Papers are abstracted separately.) **DWB**—This issue contains seven papers on various aspects of earth satellites and moon or space rockets by experts working with various phases of the "Project Vanguard" (for development of an earth satellite for IGY). The papers are all followed by discussions by the other members of the "Rockets-for-Peace" symposium at the Franklin Institute in Philadelphia. Speakers were HOMER NEWELL, GEORGE CLEMENT, K. A. EHRICKE, LYMAN SPITZER, JOHN DE NIKE, LOWELL LAWRENCE and R. W. PORTER, and the topics included recovery of data, orbits, biosatellites, International Geophysical Year program, etc. Papers are abstracted separately. (*Same item as* 8.4–3, April 1957, *Met. Abstr.*) *Subject Heading:* **1. Earth satellite symposia.**—*M.R.*

11J–47 551.506.7:551.507.362.2:551.576

Fritz, Sigmund (*U. S. W. B., Wash., D. C.*), **On observing the atmosphere from satellites, Pt. 1, Cloud observations.** *Weatherwise*, Boston, 12(4):139–144; 163–165, Aug. **1959.** 2 figs., table, 13 refs. **DWB**—Most proposed programs for a meteorological satellite involve radiation measurements of one kind or another. Cloud amount, cloud type, cloud patterns, distance in height and range

which may be tolerated, present quality of equipment, photocells used in Vanguard II, difficulties due to great height of satellite and spin rate, television cameras proposed for Project TIROS, effect of resolution, filters, spectral intervals, future improvements such as radar, stabilization, etc., and needed research are clearly described and illustrated. *Subject Headings:* **1. Satellite observation techniques 2. Satellite cloud observations.**—*M.R.* Ⓢ

11J–48 551.507.362.2:629.19:551.524.7

Gast, P. R. (*U. S. A. F., Cambridge Res. Ctr.*), **Insolation of the upper atmosphere and of a satellite.** (In: Van Allen, James A. (*ed.*), **Scientific uses of earth satellites.** Ann Arbor, Univ. of Michigan Press, **1956.** p. 73 84. 4 figs., 4 tables.) **DWB, DLC**—Three factors determine satellite temperature: 1) direct solar radiation, 2) returned solar radiation (both at 6000°K) and 3) long wave (250°K) radiation from earth. Ranges of maximum and minimum temperature at various distances from earth and in sun and shadow are calculated for proposed trajectories. Difficulties involved in measurements of temperature and albedo are mentioned. Range for 300–1000 mi orbit are from 13°C to −3°C for 3 possible cases. (*Same item as* 8.9–68, Sept. 1957, *Met. Abstr.*) *Subject Headings:* **1. Satellite temperatures 2. Satellite temperature calculations.**—*M.R.*

11J–49 551.507.362.2

*†Glaser, Arnold H., **Meteorological utilization of images of the earth's surface transmitted from a satellite vehicle.** Blue Hill Meteorological Observatory, Contract AF 19(604)-1589, Phase II, [Unnumbered report], Oct. 31, **1957.** 145 p. 43 figs., 3 tables, 35 refs. **DWB** (M07.362.2 G548me) —The purpose of this work is to check the potential use of satellites as meteorological observatories. Several problems related to global and local observations of cloud and wind systems are considered in general, and discussed specifically in terms of radio communication channel capacity vs. cloud identification which is the crux. Meteorological features discernible at various resolutions into (1) major systems >50 miles, (2) meso systems 1–50 miles and (3) <1 mile are given in semi-qualitative curves. The discussion is enhanced by presentation of experimentally reconstructed brightness maps simulating satellite observations in order to illustrate how these patterns represent some synoptic situations better than the usual surface analyses. A novel cloud classification system is offered. A program urging field measurements of the optical properties of clouds, cloud systems and synoptic systems is suggested to provide basic data to the satellite designers and the meteorologists. *Subject Headings:* **1. Satellite uses 2. Synoptic cloud observations 3. Weather satellites.** —*W.N.*

11J–50 551.507.362.2:621.397

Glaser, Arnold H. (*Allied Res. Assoc., Inc., Boston*), **Satellite television for meteorology.** *Weatherwise*, Boston, 10(6):183–186, 213, Dec. **1957.** fig., photos. **DWB**—Suggestions for development of a satellite TV weather observation system involving rapid spin, photocell scanner and "memory" storage of information to be employed over areas remote from receiving stations. The information would be released in a "burst" while the satellite was over a ground receiver. The scanning would be in strips perpendicular to the trajectory of the satellite. The faster the spin of the satellite, the closer will be the strips but the poorer the resolution, unless the optical system is improved markedly. At present, objects of less than 1 mi diameter could not be seen and up to resolution over months or years. (*Same item as* 10.4–74, April 1959, *Met. Abstr.*) *Subject Heading:* **1. Satellite television observation techniques.**—*M.R.*

11J–51 551.507.362.2:551.508

Glaser, Arnold H. (*Allied Research Associates, Inc., Boston*), **System for the meteorological use of satellite television observations.** *U. S. Air Force. Cambridge Research Center, GRD Research Notes*, No. 36:63–91, June **1960.** 4 figs. (incl. photo). **DWB**—A discussion of the plans for orbiting of meteorological satellites, equipped with a television camera of near-conventional design for the purpose of telemetering of pictorial data to the data acquisition station. At the station a filmed reconstruction of each picture will be delivered to the meteorological group. This group will establish the locations of the pictures and of features contained therein. Significant meteorological features will be transferred to maps and interpretations of the significance of the features will be made. *Subject Headings:* **1. Weather satellites 2. Satellite instrumentation.**—*I.S.* Ⓢ

11J–52 551.521.14:551.507.362.2

Godson, Warren L. (*Atmospheric Res. Section, Met. Branch, Canada*), **Meteorological applications of earth satellites.** *Royal Astronomical Society of Canada, Journal*, 52(2):49 56, April **1958.** 4 tables, 12 refs. **DLC, DWB** (Reprint file)—The paper points to the tremendous value of satellite observations for the science and practice of meteorology. The albedo experiment, radiation balance of the earth's atmosphere and its complex relation to the general circulation of the atmosphere, spectral investigation of solar and atmospheric radiation, and the meteorological implication of

geophysical experiments are discussed. *Subject Headings:* **1. Satellite uses in meteorology 2. Satellite program 3. Albedo measurements.**—*E.N.*

11J–53 551.507.362.2:551.508

Goldberg, E. A. and Landon, V. D. (*both, RCA Astro-Electronic Products Div., Princeton, N. J.*), **Key equipment for Tiros I.** *Astronautics*, N. Y., 5(6):36–37, 96–99, June **1960.** fig., photos. **DLC**—Some of the key components and functions of the TV camera subsystem, tracking and telemetry, position reference, power supply and dynamics control subsystems of Tiros I are described. Photos accompanying this article include one that shows the array of Tiros I equipment shown exposed on the satellite's base; another shows the command receiver and the wide angle TV camera and specifications. A diagram of the TV camera system is included. *Subject Headings:* **1. Satellite instrumentation 2. U. S. satellite, 1960 Beta (Tiros I).**—*E.Z.S.* Ⓢ

11J–54 551.507.362.2:551.508

Goldshlak, A. L. (*Allied Res. Assoc., Inc., Boston*), **Applications of meteorological satellites.** *U. S. Air Force. Cambridge Research Center, GRD Research Notes*, No. 36:7–21, June **1960.** 3 figs. **DWB**—Possible applications of meteorological satellite data are investigated. Pertinent material, selected from a vast assortment of literature, is presented. Section 1.4 consists of a discussion of meteorological parameters. This section contains references to literature which makes specific suggestions concerning methodology and instrumentation. The literature presented in this section also provides suggestions which relate to the design of the satellite meteorology system. *Subject Headings:* **1. Weather satellites 2. Satellite instrumentation.**—*I.S.* Ⓢ

11J–55 551.507.362.2:551.521:551.524.7

*Goldman, D. T. and Singer, S. Fred, **Studies of a minimum orbital unmanned satellite of the earth (MOUSE), Pt. 3, Radiation equilibrium and temperature.** *Astronautica Acta*, Vienna, 3(2):111–129, **1957.** 14 figs., 16 refs., 3 eqs. German, English and French summaries p. 110–111. **Pt. 4, Radiation equilibrium and temperature.** *Maryland Univ. Physics Dept. Technical Report*, No. 46, June **1956.** 31 p. 12 figs., 2 tables, 16 refs., numerous eqs. (For Pt. 1, and 2, *see* 11J–152.) **DWB**—In Pt. 3 the various types of radiation which affect the temperature of the satellite are discussed in order to establish a definite procedure for calculating the equilibrium temperature of the sphere. The various parameters are: the surface properties, shape and size of the satellite, of the earth directly below, orbit (height, inclination, orientation), etc. Solar and terrestial radiation, planetary temperature, infrared radiation from earth and other energy sources are first discussed quantitatively. Then the method of calculation of the satellite temperature is developed and, lastly, the problems of internal heat generation, conductivity, and nonuniform heat distribution are treated. Four appendices give detailed and practical data on earth's albedo, construction of nomogram, determination of angle between orbit of sun and of satellite, and absorption of visible solar radiation. In Pt. 4 nomograms and tables are presented for calculating the temperature and heat exchange of a satellite, based on the latest literature (which is amply cited) on radiation from sun, reflected from earth and long wave radiation from earth. The albedo and thermal properties of the satellite's skin and interior are important factors. Meteors, cosmic rays, collisions, etc., are involved. *Subject Headings:* **1. Satellite temperature calculations 2. Radiation equilibrium of MOUSE.**—*M.R.*

11J–56 551.507.362.2

Greenfield, Stanley M. and Kellogg, W. W., **Satellite weather reconnaissance.** *Rand Corporation, Santa Monica, Calif.*, [*Publication*], P-1402, June 12, **1958.** 20 p. 5 figs., 6 refs., eqs. **DWB** (M(055) R186p)—Various aspects of weather reconnaissance by satellite—limitations, capabilities relative to present methods and growth potentials—are discussed. From satellites an overall coverage and continuity of weather observation can be obtained but this has limitations discussed in this preliminary report. Detailed studies are still underway to overcome the limitations and develop satellite weather reconnaissance. *Subject Headings:* **1. Satellite weather reconnaissance 2. Weather satellites.**—*N.N.*

11J–57 551.507.362.2

Greenfield, Stanley M. and Kellogg, William W. (*both, Rand Corp., Santa Monica, Calif.*), **Weather reconnaissance by satellites.** *Astronautics*, N. Y., 4(1):32–33, 77–78, Jan. **1959.** figs., port (vita). **DLC**—The world-wide weather data collection network provides very limited information about oceans and polar regions. The introduction of satellites will provide additional data. With satellites, it will be possible to study clouds and obtain a synoptic picture. Cloud observations from a satellite could allow the synoptic meteorologist to view the entire weather pattern. Other information which can be gathered from a satellite include total moisture content, total ozone content, temperature at tropopause, total radiation, etc. Already enough work has been done to prove the usefulness of satellites for weather reconnaissance. *Subject Headings:* **1. Satellite uses 2. Cloud photography 3. Satellite weather reconnaisance.**—*A.H.K.* Ⓢ

11J–58 551.510.53:551.507.362.2:551.521.18

Greenfield, S. M. and Kellogg, W. W. (*both, Rand Corp.*), **Calculations of atmospheric infrared radiation as seen from a meteorological satellite.** *Journal of Meteorology*, Boston, 17(3):283–290, June **1960.** 9 figs., table, 24 refs., 6 eqs. **DWB, DLC**—Since certain constituents (water vapor, ozone, carbon dioxide, etc.) of the atmosphere have pronounced absorption and emission bands in the infrared region of the spectrum, the radiation which is radiated upward from the atmosphere will depend on the distribution and temperature of the constituents, and this radiation can be measured from meteorological satellites. This paper shows sample calculations of the emission by the water vapor in three wavelength intervals (at two places in the strong absorption band, 6.0 and 6.2μ, and in the region of weak absorption, 8 to 13μ). Water-vapor distributions used in these calculations are those for the United States, measured by the University of Chicago and showing rather high stratospheric humidities; for the United Kingdom, measured by the Farnborough Research Establishment and showing rather low stratospheric humidities; and for Swan Island, West Indies, where no humidity data were available above about 10 km. It is shown that, for very strong absorption by water vapor (as at 6.0μ) and the United States humidity distribution, the upward emission originates mostly in the stratosphere, whereas, for weaker absorption or lower stratospheric humidities, the upward emission comes mostly from below the tropopause. In the water vapor "window" at 8 to 13μ, about two-thirds of the upward emission in the vertical comes from the ground in middle latitudes (low humidities), but only about one-third of the surface radiation escapes in the tropics; i.e., the "window" is not at all transparent. *Subject Headings:* **1. Weather satellites 2. Infrared radiation measurements 3. United States 4. United Kingdom 5. Swan Island, Caribbean Sea.**—*Authors' abstract.* Ⓢ

11J–59 551.507.362.2:551.510.3:551.510.536

Grimminger, George (*U. S. Air Force, Wash., D. C.*), **Density of the upper atmosphere.** *Nature*, London, 183(4664):811–812, March 21, **1959.** 3 refs. **DWB**—This is an interesting comparison between tabulated data theoretically arrived at by the author before any artificial satellites or rockets were used (*see* 8–31, Aug. 1950, *Met. Abstr.*), and data obtained by means of satellites. It shows that there is more agreement than not depending on the values of latitudes. *Subject Headings:* **1. Satellite density measurements 2. Upper atmosphere densities.**—*W.N.* Ⓢ

11J–60 551.507.362.2:551.510.3

Groves, G. V. (*Dept. of Physics, Univ. Coll., London*), **Irregularities of satellite drag and diurnal variations in density of the air.** *Nature*, London, 182(4648):1533–1534, Nov. 29, **1958.** ref. [Comment (entitled **Atmospheric tides and earth satellite observations**)] by D. G. Parkyn [and] **Reply** by Groves. *Ibid.*, 183(4667):1045–1047, April 11, **1959.** 2 figs., 4 refs., eq. **DWB**—The marked change in the slope of the period-time curves of Sputnik 2, Sputnik 3 and Sputnik 3 rocket has led to the belief that the density of the air at a height of 220 km increases considerably between latitude 35°N and 28°N. The sudden increase in drag is considered instead to be associated with the passage of the perigee from the night-side to the day-side of the Earth, so that the change results chiefly from the precession of the orbital plane instead of from the rotation of the perigee in the orbital plane. This explanation accounts more easily for the suddenness of the change, since the orbital plane precesses about ten times faster than the perigee rotates in the orbital plane. The solar heating that seems to be responsible for the increase in density at 220 km occurs probably in the region of 100 km and the expansion of the air at this level lifts the atmosphere above. Tidal variation in the density could be studied with spherical satellites which eliminate the fluctuations in the period-time curve due to the changes of aspect in the rocket. *Subject Headings:* **1. Atmospheric drag 2. Satellite orbits 3. Soviet satellite, 1957 Beta (Sputnik II) 4. Soviet satellite, 1958 Delta (Sputnik III).**—*I.L.D.*

11J–61 551.507.362.2:521.312:551.510.53:551.510.3

Groves, G. V. (*Dept. of Physics, Univ. College, London*), **Air density in the upper atmosphere from satellite orbit observations.** *Nature*, London, 184 (4681), Supp. No. 4:178–179, July 18, **1959.** table, 8 refs. **DWB**—From the change of period of a satellite, the density of the atmosphere at various perigee heights of the ten successfully launched satellites was derived. The perigee heights of 6 satellites have been less than 230 km. The values derived from an analysis of data from these six satellites are tabulated. The accuracy estimated is of the order of 20% at the lower heights and 50% at the greater heights. Above 300 km, Explorer I and Vanguard I observations have been the chief sources of values of air density. These observations are analyzed and discussed. *Subject Headings:* **1. Satellite density measurements 2. Upper atmosphere densities.**—*I.S.* Ⓢ

11J–62 551.507.362.2:551.510.3:551.510.53

Groves, G. V. (*Dept. of Physics, Univ. College, London*), **Determination of upper-atmosphere air density and scale height from satellite observations.** *Royal Society of London, Proceedings,*

Ser. A, 252(1268):16-27, Aug. 25, **1959.** 5 figs., 2 tables, 13 refs. **DWB, DLC**—A solution is obtained for the rate of change of semimajor axis and perigee distance of a satellite orbit with time due to the resistance of the atmosphere. The logarithm of air density is assumed to vary quadratically with height, and the oblateness of the atmosphere is taken into account. The calculation of perigee air density in terms of the rate of change of satellite period is dealt with; and the method is applied to data at present available on six different satellites. The variation of air density with height is obtained as

$$\ln \rho = -28.59(\pm 0.15) - (h-200)/46(\pm 5) + 0.028(\pm 0.013)(h-200)^2/(46)^2$$

for h in the range of approximately 170 to 700 km, where ρ is in grams/cm^3, h is in kilometers and standard deviations are given in brackets. (*Same item as* 11.5-164, May 1960, *Met. Abstr.*) *Subject Headings:* **1. Upper atmosphere density measurement techniques 2. Satellite density measurements.** —*Author's abstract.*

11J–63 551.507.362.2:551.510.3:551.510.53

Groves, G. V. (*Dept. of Physics, Univ. College, London*), **Determination of upper-atmosphere air-density profile from satellite observations.** *Royal Society of London, Proceedings, Ser. A*, 252(1268):28–34, Aug. 25, **1959.** 2 figs., 4 refs., 64 eqs. **DWB, DLC**—The theory previously developed (*see* 11J–62 above) for the changes in the perigee distance and semimajor axis of a satellite orbit due to air drag is extended to enable the air density profile (i.e., its relative variation with height) to be derived from the motion of the orbit's perigee. The solution is first obtained in terms of the change in perigee distance and then in terms of the change in the radius of the earth at the subperigee point. Data are analyzed by the two methods, leading to 39(±9) and 36(±15) km for the scale height in the 180 and 220 km altitude regions. (*Same item as* 11.5–165, May 1960, *Met. Abstr.*) *Subject Headings:* **1. Upper atmosphere density measurement techniques 2. Satellite density measurements.**—*Author's abstract.*

11J–64 551.507.362.2:551.506.22

Hagen, John P., **The satellite program—physical aspects.** *Ciencia*, Mexico City, 16(11/12):323–334, **1956.** 14 figs. **DWB**—A model cross-section of the earth's atmosphere to 600 km, the projected orbit, lifetime of satellite at various heights, the Vanguard and its launching vehicle and trajectory and spectral information to be extended by data from the satellite are nicely illustrated and discussed in this comprehensive article on physical data and aspects of the proposed U. S. satellite. (*Same item as* 9.8–26, Aug. 1958, *Met. Abstr.*) *Subject Headings:* **1. IGY satellite program 2. Satellite observations 3. Project Vanguard 4. U. S. satellites.**—*M.R.*

11J–65 551.507.36.2:629.19

Hagen, John P. (*Naval Res. Lab., Wash., D. C.*), **The exploration of outer space with an earth satellite.** *Institute of Radio Engineers, N. Y., Proceedings*, 44(6):744–747, June **1956.** 5 figs. **DLC**—Sometime during the coming Geophysical Year (July 1957 to Dec. 1958) an attempt will be made to launch an artificial satellite in an orbit around the earth. The Office of Naval Research has been assigned the responsibility to perform this task and has established Project Vanguard in the Naval Research Laboratory to carry it out. The Dept. of Defense turned to the Navy to manage this triservice project because of its extensive experience in upper-atmosphere research with rockets. The satellite which Project Vanguard intends to launch in an orbit is a small one, yet must be a research vehicle. The National Committee for the IGY of the National Academy of Sciences has established a panel which is concerned with the nature of the scientific experiments to be done in the vehicle. Work is in progress not only on the vehicles, but on the experiments to be done in the satellite. Experiments conducted in an artificial earth satellite circling the earth in the outer tenuous region of our atmosphere can greatly increase our knowledge of the atmosphere—its structure, its constituents, and the powerful radiations both electromagnetic and corpuscular that impinge upon it and help determine its state. (*Same item as* 8.1–133, Jan. 1957, *Met. Abstr.*) *Subject Headings:* **1. Satellite observatories 2. Project Vanguard 3. U. S. satellites 4. Outer atmosphere investigation.**—*Author's abstract.*

11J–66 551.507.362.2:551.510.3:551.510.536

Harris, I. and Jastrow, R. (*both, Nucleonics Div., U. S. Naval Res. Lab., Wash., D. C.*), **Density determinations based on the Explorer and Vanguard Satellites.** *Science*, Wash., D. C., 128(3321):420–421, Aug. 22, **1958.** 2 tables, 5 refs. **DLC**—Tabulated data for (1) orbital periods for Explorer I and (2) orbital periods for Vanguard I as obtained by the Vanguard Computing Center from Minitrack data are presented along with (3) densities derived from satellite data as above and at altitudes of 405 and 720 km, respectively. The analysis was made to permit a rough estimation of density of the atmosphere at lat. 33°N and 33°S. Because of strong dependence of upper air densities

upon latitude, comparison between U. S. and U.S.S.R. density values was not made. *Subject Headings:* **1. Satellite density measurements 2. Upper atmosphere densities 3. U. S. satellite, 1958 Alpha (Explorer I) 4. U. S. satellite, 1958 Beta (Vanguard I).**—*W.N.*

11J–67 629.19:551.507.362.2:521.312

Haviland, R. P. (*Special Defense Projects Dept., General Electric, Philadelphia*), **What the future holds for the earth satellite.** *General Electric Review,* Schenectady, N. Y., 59(5):10–16, Sept. **1956.** 10 figs., 2 tables. **DLC**—The possible orbits and respective areas of the earth which could be seen from a satellite at 300 mi, 4000 mi; or the areas over which a satellite at a height of 22,300 mi could relay radio or TV signals from hemisphere to hemisphere or within the Western Hemisphere are shown on maps. Tables give distances of vision, field of view, etc. for heights of 257, 620, 1210, 2222, 4000, 7650, 19,000 and 22,300 mi. Weather charting and forecasting possibilities are also considered. Hurricanes, clouds, albedo and solar radiation could be measured or observed from such a station. (*Same item as* 9.1–94, Jan. 1958, *Met. Abstr.*) *Subject Headings:* **1. Satellite orbits 2. Satellite observatories.**—*M.R.*

11J–68 551.507.362.2

Hibbs, A. R. (*Jet Propulsion Lab., Calif. Inst. of Tech.*), **Scientific results from the Explorer satellites.** *International Astronautical Congress, Amsterdam, Aug. 1958, Proceedings,* Vol. 2:680–691, issued **1959.** 12 figs., table, 4 refs. **DLC** (TL787.I44)—A brief history is given of Explorer satellite launchings together with a description of payload instrumentation. A summary is presented of results of experiments made in the following areas: 1. Temperatures of both case and internal instrumentation; 2. Micrometeorite activity; 3. Cosmic ray intensity. The results of preliminary analyses of these various measurements as carried out by the responsible institutions are given, together with a discussion of their implications for future measurements of this type. *Subject Headings:* **1. Satellite observations 2. U. S. satellites.**—*Author's abstract.* Ⓢ

11J–69 551.506.7:551.507.362.2:551.501.45:519.2

Holloway, Leith (*Systems Analysis Section, U. S. W. B.*), **Correcting for unavoidable smoothing of artificial satellite data.** Wash., D. C., U. S. Weather Bureau, May **1957.** 5 p. 8 figs. "Paper presented at the 155th National Meeting of the AMS, Wash., D. C., May 2, 1957." **DWB** (629.1388 U587co)—Terrestrial data, such as infrared radiation, obtained by nondirectional sensors on artificial satellites will be unavoidably space-smoothed because the satellite will "see" a large segment of the earth at one time. The nature of this smoothing is discussed, and methods are presented for partially reversing this smoothing and thereby restoring some of the spatial variation filtered out of the data. *Subject Headings:* **1. Infrared radiation 2. Satellite radiation measurement 3. Data smoothing.**—*Author's abstract.*

11J–70 551.507.362.2:551.510.3

Horn, W., **Die Dichte der Atmosphäre in grossen Höhen, bestimmt aus den Bahnverhältnissen künstlicher Satelliten.** [Density of the upper atmosphere determined from the evolution of the artificial satellite orbit.] *Die Sterne,* Leipzig, 35(1/2):41–43, **1959. DLC**—Some anomalies in the calculations of the Sputnik and rocket orbits are mentioned. To simplify the different calculations the author considers circles instead of ellipses; he estimates that these irregularities are not of great importance in reckoning the earth's atmospheric density. For the different calculations KEPLER's law is used. (*Same item as* 10.11–65, Nov. 1959, *Met. Abstr.*) *Subject Headings:* **1. Upper atmosphere densities 2. Satellite observatories.**—*A.V.*

11J–71 551.510.3:521.312:551.507.362.2

Iatsunskiĭ, I. M., **O vliianii geofizicheskikh faktorov na dvizhenie sputnika.** [The influence of geophysical factors on the motion of a satellite.] *Uspekhi Fizicheskikh Nauk,* Moscow, 63(1):59–71, Sept. **1957.** 4 figs., 9 refs., 41 eqs. **DLC**—The geophysical factors considered are air resistance and variation of gravity due to nonsphericity of the earth. Also discussed is the possibility of determining air density, the constants of the terrestrial ellipsoid and gravitation anomalies from observations on the satellite. *Subject Headings:* **1. Satellite motion 2. Upper atmosphere density measurements.**—*Physics Abstracts, 3666, 1958.*

11J–72 550.3:061.3 551.510.53:061.3

NASA Space Science Program. *Institute of Radio Engineers, N. Y., Proceedings,* 48(4):438–450, April **1960. DLC**—This report, prepared in April, 1959, summarizes the objectives of the space sciences program of the U. S. National Aeronautics and Space Administration and the immediate and long range plans for carrying the program out. The report is divided into several broad areas: atmospheres, ionospheres, energetic particles, electric and magnetic fields, gravitational fields,

astronomy, and biosciences. Included in the discussion is a review of present knowledge and existing problems in each of the above areas. *Subject Headings:* **1. NASA space science program 2. Upper atmosphere research.**—*Author's abstract.* Ⓢ

11J–73 551.507.362:629.136.3:551.510.53

Janicki, W., **Erforschung der äusseren Erdatmosphäre mit Raketenflugzeugen und künstlichen Erdtrabanten.** [Exploration of outer layers of the atmosphere by rocketplanes and artificial satellites.] *Schweizerische Technische Zeitschrift*, Berne, 54(20):429–441, May 16, **1957.** 10 figs. **DLC**—IGY satellite program covering: direct and indirect geophysical information that can be obtained by satellites on the following phenomena: temperature, pressure and density of the air in the outer atmosphere, distribution of the mass in the earth's crust, geodetic information, meteorites, solar radiation, density of hydrogen in the interplanetary space, cosmic rays and polar auroras. (*Same item as* 11.2–78, Feb. 1960, *Met. Abstr.*) *Subject Headings:* **1. Rocket observation of the upper atmosphere 2. Satellite observation of upper atmosphere 3. IGY satellite program.**—*A.V.*

11J–74 551.521.1:551.510.3:551.510.53:551.507.362.2

Jacchia, Luigi G. (*Smithsonian Inst., Astrophysical Obs., Cambridge, Mass.*), **Two atmospheric effects in the orbital acceleration of artificial satellites.** *Nature*, London, 183(4660):526–527, Feb. 21, **1959.** 2 figs., 8 refs. **DLC**—The orbital acceleration of artificial earth satellite shows fluctuations, unexplainable on gravitational grounds. This effect is explained by a solar-radiation hypothesis—that the rotation of the sun, which has a synodic period of 27 days, could be responsible for changes in upper-atmosphere densities through variable radiation. Another effect, detected in satellites, which is tied to solar radiation is a variation of the orbital acceleration with the angular distance of the perigee from the sub-solar point. *Subject Headings:* **1. Solar effects on upper atmosphere density 2. Satellite acceleration.**—*I.S.* Ⓢ

11J–75 551.507.362.2:551.510.53:551.510.3

Jacchia, Luigi G., **Variable atmospheric-density model from satellite accelerations.** *Smithsonian Institution. Astrophysical Observatory, Special Report* No. 39, March 30, **1960.** 15 p. 3 figs., 3 tables, 8 refs., 10 eqs. **DWB**—Satellite accelerations are analyzed by an empirical formula that relates the product $\rho H^{\frac{1}{2}}$ (ρ =atmospheric density, H =scale height) to the geometric height z, the 20-cm solar flux F_{20}, and the angular distance ψ' from the center of the diurnal bulge. Once the numerical parameters of this formula have been established, tables of ρ and H are computed and a separate formula is derived to represent ρ in function of the same variables. *Subject Headings:* **1. Air density effects on satellites 2. Atmospheric density models 3. Satellite acceleration.**—*Author's abstract.* Ⓢ

11J–76 551.501.71:551.510.53:551.510.3:551.507.362.2

Jacchia, Luigi G., **Effect of a variable scale height on determinations of atmospheric density from satellite accelerations.** *Smithsonian Institution. Astrophysical Observatory, Special Report*, No. 46, July 11, **1960.** p. 1–4. 2 figs., table. **DWB**—Formulas for the determination of atmospheric densities from satellite accelerations assume that the scale height is constant at heights immediately above perigee. The error of these formulas is evaluated for an atmosphere in which, from a representative value at perigee, the density scale height increases linearly with height at different rates. *Subject Headings:* **1. Density gradient in upper atmosphere 2. Satellite acceleration.**—*Author's abstract.* Ⓢ

11J–77 551.507.362.2:629.13

Jastrow, R. and Pearse, C. A. (*both, U. S. Naval Res. Lab., Wash., D. C.*), **Atmospheric drag on the satellite.** *Journal of Geophysical Research*, Wash., D. C., 62(3):413–423, Sept. **1957.** 7 figs., 9 refs., 14 eqs. **DLC**—The drag exerted on the satellite in its orbit arises from collisions with neutral air particles and partly from losses associated with the passage of a charged sphere through an ionized medium. It is found that the charged and neutral effects are comparable under the atmospheric conditions expected at an orbital altitude of 300 mi. (*Same item as* 9.9–73, Sept. 1958, *Met. Abstr.*) *Subject Headings:* **1. Satellite drag 2. Neutral air particle collisions.**—*Authors' abstract.*

11J–78 551.507.362.2:551.521.64

Jastrow, Robert, **Artificial satellites and the earth's atmosphere.** *Scientific American*, New York, 201(2):37–43, Aug. **1959.** figs. **DLC, DWB**—Fundamental discoveries by LUIGI JACCHIA and others about the radiation belts and the variable drag on satellites passing through these belts during and between 27-day periods of solar activity, are clearly described and illustrated. Models of the atmospheric density or temperature are quite different for the auroral zone from those for the rest of the earth. Temperatures in the auroral zone are much higher than elsewhere due to the

lowering of the Van Allen radiation belt in the auroral zones. This belt has an increase in particle density during solar activity. *Subject Headings:* **1. Satellite radiation observations 2. Van Allen belt 3. Solar activity. I. Jacchia, Luigi.**—*M.R.* Ⓢ

11J–79 551.506.22:551.507.362:551.524.7:551.510.3 523.42/3

†Jastrow, Robert (*N. A. S. A., Wash., D. C.*), **Outer atmospheres of the earth and planets.** *Journal of Geophysical Research*, Wash., D. C., 64(11):1789–1798, Nov. **1959.** 7 figs., 29 refs., 2 eqs. **DLC**—The first paragraph briefly summarizes the salient facts about the outer atmosphere of Mars and Venus. This is followed by a survey of the lunar atmosphere. Here the author refers to recent calculations, which show the lunar atmosphere seriously reduced by the effects of the solar wind. The measurement of temperature and density in the terrestrial atmosphere was one of the most interesting results of the IGY upper atmosphere program. The density of the atmosphere was determined from satellite tracking data, and also by rockets. The temperature can be determined indirectly from the altitude dependence of the density measurements. Further, the disagreement of rocket and satellite results, the effect of the Van Allen belt, atmospheric models and the origin of the aurora are discussed. *Subject Headings:* **1. Planetary atmospheres 2. IGY research 3. Upper atmosphere density measurements 4. Upper air temperature measurements 5. Satellite tracking.**—*E.K.* Ⓢ

11J–80 551.507.362.2:551.510.3:551.524.7

Jastrow, Robert (*Natl. Aeronautics and Space Admin.*), **Upper-atmosphere density and temperature.** *American Geophysical Union, Transactions*, 41(1):91–94, March **1960.** 5 figs. **DWB, DLC**—A note on atmospheric density and temperature as determined by analysis of satellite data. This analysis, combined with rocket data for lower altitudes, has revealed additional features that promise a broader understanding of upper-atmospheric dynamics. Perhaps the most important among these is the evidence that upper-atmosphere properties in the auroral zones are strongly equatorial latitudes. The paper is nicely illustrated by graphical representations. *Subject Headings:* **1. Upper atmosphere densities 2. Upper air temperature 3. Upper atmosphere properties 4. Satellite data 5. Rocket data.**—*I.S.* Ⓢ

11J–81 551.510.3:551.507.362.2:629.19

Jones, L. M. and Bartman, F. L. (*Engr. Res. Inst. and Dept. of Aeronautical Engr., Univ. of Michigan, Ann Arbor*), **Satellite drag and air-density measurements.** (In: Van Allen, James A. (*ed.*), **Scientific uses of earth satellites.** Ann Arbor, Univ. of Michigan Press, **1956.** p. 85–98. 8 figs., table, 2 refs., eq.) **DWB, DLC**—The problems of obtaining density values at satellite altitudes from drag measurements on the satellite are discussed. Tracking measurements alone will yield only average densities over many orbits. In the final high-drag phase, the distance over which the density average is taken will be somewhat less but will be at lower altitudes. Instantaneous measurements of drag with an accelerometer will permit synoptic measurements of density or improve the precision of average density measurements. Results early in the life of the satellite will be possible, thus increasing the probability of obtaining results. A 5-lb, 5-ft-diameter inflated sphere is proposed. It would carry an improved version of the transit-time accelerometer used in Michigan sphere-drop density experiments. The required improvement in accelerometer performance and such problems as inflation, active satellite life, and ground stations are discussed. (*Same item as* 9.2–102, Feb. 1958, *Met. Abstr.*) *Subject Headings:* **1. Satellite air density measurement 2. Satellite drag.**—*Authors' abstract.*

11J–82 551.507.362.2:551.508

Instrumentation in the third Soviet sputnik. *Journal of Scientific and Industrial Research, Sec. A*, New Delhi, 17(10):401–403, Oct. **1958. DWB, DLC**—Discussion of characteristics and instrumentation of the 3rd Soviet sputnik, launched May 15, 1958. Details include orbit, shell, radio, thermal control, power, meteorological, electrical, radiation, magnetic, cosmic-ray, ion, solar batteries, etc. *Subject Headings:* **1. Soviet satellite, 1958 Delta (Sputnik III) 2. Satellite instrumentation.**—*M.R.*

11J–83 551.507.362.2

Kallmann, H. K.; Kellogg, W. W.; Rapp, R. R. and Greenfield, S. M., **Scientific use of an artificial satellite.** *Rand Corporation, Santa Monica, Calif.*, [*Publication*] P-733, Sept. 6, **1955.** 22 p. 26 refs. **DWB** (M055 R186p)—An early review of general areas where there are possible uses for earth satellites in studies of solar radiation, in the UV and X-ray region, electron density measurements; pressure, density and atmospheric composition measurements; cosmic rays, albedo of the earth, artificial seeding of the atmosphere, geodetic measurement, and cosmic or solar high frequency radio noise. *Subject Headings:* **1. Satellite uses.**—*M.R.*

11J–84 551.507.362.2:629.19

Kallmann, H. K. and Kellogg, W. W., **Use of an artificial satellite in upper air research.** *American Meteorological Society, Bulletin*, 38(1, Pt. 1):17–19, Jan. **1957.** fig. **DWB, DLC.** Also in *Rand Corporation, Santa Monica, Calif., Papers*, P-760, Feb. 15, **1956.** 9 p. 2 figs. **DWB**—The meteorological problems which could be solved by satellite observations of cosmic ray primaries and secondaries, micrometeorites, meteorites, ultraviolet intensities, x-ray radiation, solar variations, solar constant, albedo, magnetic field, size and shape of the earth, etc. are discussed. Seeding with known gases to help track the satellite and to determine composition of high atmosphere, artificial meteors sprayed from the satellite, electron density determinations, temperature and density measurements, etc. are also discussed. (*Same item as* 8.9–69, Sept. 1957, *Met. Abstr.*) *Subject Headings:* **1. Satellite uses 2. Satellites observatories 3. Upper air research.**—*M.R.*

11J–85 551.507.362.2:550.3:061.3

Kaplan, Joseph and Odishaw, Hugh (*both, U. S. Nat. Com., Int. Geophysical Year*), **Satellite program.** *Science*, Washington, D. C., 122(3178):1003–1005, Nov. 25, **1955. DLC.** Also their: **U. S. satellite program,** *Current Science*, Bangalore, 25(2):45–46, Feb. **1956. DWB, DLC**—The earth satellite program had its inception in Oct. **1954** in a resolution of CSAGI (at Rome) recommending that the possibility of launching such vehicles with instruments and telemetering devices, be considered for IGY in 1957/58. The program took definite shape in July 1955 with the announcement by President Eisenhower of the United States of plans for launching such vehicles, subject to international observation and use of data. A 13th panel for IGY was formed in the U. S. National Committee for IGY. Members include, Odishaw, Kaplan, H. E. Newell, A. F. Spilhaus, F. L. Whipple and others. Program calls for launching at least 10 instrumental satellites the size of a basketball, with an orbit from 200 to 800 mi from earth, a speed of 18,000 mph, and to be a week or more in orbit. (*Same item as* 7.6–21, June 1956, *Met. Abstr.*) *Subject Heading:* **1. IGY satellite program.**—*M.R.*

11J–86 551.507.362.2

Keigler, John E. and Oakley, Charles B. (*both, RCA Astro-Electronic Products Div., Princeton, N. J.*), **The Tiros system on the ground.** *Astronautics*, N. Y., 5(6):44–45, 100–102, June **1960.** figs. **DLC**—The wide spread complex data receiving stations, data preparation and data utilization agencies, a computation center, and a system contract command, constituting the ground system for Tiros are briefly described. The ground system complex and tracking loop are illustrated. Flow diagrams show the command and control subsystem, ground station TV receiver system and the ground station beacon receiver system. *Subject Headings:* **1. Satellite ground systems 2. U. S. satellite, 1960 Beta (Tiros I).**—*E.Z.S.* Ⓢ

11J–87 551.507.362.2

Kelly, Joseph J. (*Martin Co., Md.*), **Earth satellites.** *Weatherwise*, Boston, 8(5):121–122, Oct. **1955.** photo. **DWB**—The value of an earth satellite to meteorology is discussed. Suggested measurements include analysis of specific infrared band from earth, "strength and direction of the high frequency radio communications link as it sweeps through the atmosphere," measurement of solar radiation outside the atmosphere, influence of meteoric dust upon the attenuation of radiation. (*Same item as* 8.6–63, June 1957, *Met. Abstr.*) *Subject Heading:* **1. Satellite uses.**—*I.L.D.*

11J–88 551.507.362.2:535.242:551.524.7

King, Jean I. F. (*Geophysics Research Directorate Air Force Cambridge Research Ctr.*), **The earth satellite vehicle as a stratosphere temperature probe.** *International Astronautical Congress, Proceedings of the 7th Congress, Rome, 1956*, issued Rome, **1956.** p. 821–823. 11 eqs. **DLC** (TL787.144)—The satellite offers a means for the study of the earth in the light of its own spectrum. Accurate measurement of the infrared limb-darkening yields information as to the vertical thermal structure. The author suggests the construction of a photometer furnished with interference filters. This would provide a spectral scan of sorts. A limb-darkening scan would be obtained by a proper distribution of the sensing elements on the satellite surface. *Subject Headings:* **1. Satellite temperature observations 2. Stratospheric temperature measurement techniques 3. Satellite instrumentation 4. Photometers.**—*E.K.*

11J–89 551.510.3:551.510.53:551.507.362.2

King-Hele, D. G. and Walker, D. M. C. (*both, Royal Aircraft Estab., Farnborough, Hants*), **Irregularities in the density of the upper atmosphere: results from satellites.** *Nature*, London, 183(4660):527–529, Feb. 21, **1959.** 2 figs., 10 refs. **DLC**—Irregularities in air density, especially at heights between 180 and 225 km, tend to recur at intervals of about 28 days and there is reason to believe that this periodicity is related to solar disturbances. Results from satellites, Sputniks 1, 2, and 3, Explorer 1, 3, and 4 and Vanguard 1 are discussed and graphically represented in support

of this hypothesis. *Subject Headings:* **1. Upper atmosphere density variations 2. Satellite density measurements 3. Solar effects on upper atmosphere density 4. Soviet satellites 5. U. S. satellites.**—*I.S.* Ⓢ

11J–90 551.507.362.2:551.510.3:551.510.536

King-Hele, D. G. (*Royal Aircraft Estab., Farnborough*), **Density of the atmosphere at heights between 200 KM and 400 KM, from analysis of artificial satellite orbits.** *Nature*, London, 183(4670): 1224–1227, May 2, 1959. 2 figs., 2 tables, 26 refs., 7 eqs. **DLC**—The article summarizes the previous methods of estimating the action of atmospheric drag which makes the orbit of an earth satellite contract. The methods previously used in estimating this air density are difficult because the effective cross-sectional areas and drag coefficients of the satellites are difficult to determine exactly. In the present article values of the density have been derived from all the ten satellites launched up to the end of 1958. Since their orbits are known it has been possible to treat the satellites' data consistently. This is a more accurate method of determining the air density values at certain heights near the perigee. *Subject Headings:* **1. Upper atmosphere densities 2. Satellite density measurements.**—*N.N.* Ⓢ

11J–91 551.507.362.2:551.510.53:551.510.3

†King-Hele, D. G. (*Royal Aircraft Estab., Farnborough*), **Density of the upper atmosphere from analysis of satellite orbits: further results.** *Nature*, London, 184(4695):1267–1270, Oct. 24, 1959. 2 figs., 2 tables, 23 refs., 6 eqs. **DWB**—The article describes a refined method of determining air density from the rate of contraction of satellite orbits. The data is taken from the satellite experiments of 1959 at a height of 180–800 km. The decrease in the orbital period can be measured by the integrated effect of air drag around the orbit. The experiments show that the density at a given height below 300 km does not depart from its average value by a factor of more than 1.5 as a result of latitude variations. Density at 200–250 km is higher on the sunlit half of the earth than on the darker half. *Subject Headings:* **1. Upper atmosphere densities 2. Satellite density measurements.**—*A.H.K.* Ⓢ

11J–92 551.507.362.2:521.6:551.510.53:551.510.3

King-Hele, D. G. and Walker, (Mrs.) D. M. C. (*both, Royal Aircraft Establishment, Farnborough, Hants*), **Variation of upper-atmosphere density with latitude and season: Further evidence from satellite orbits.** *Nature*, London, 185(4715):727–729, March 12, 1960. 3 figs., 11 refs. **DWB**—Observations obtained from satellite orbits proved that solar disturbances are the main factor influencing the air density at heights of 200–300 km, giving rise to variations which have an amplitude of about ±20% and a periodicity of about 28 days. Day to night changes may also possibly have an effect with the density not more than 10% above average by day. Variations of air density with latitude and season were found small. At 300–700 km the variation from day to night has a greater amplitude than the 28-day variation due to solar disturbances. The value of density deduced from the orbit of Sputnik III, Sputnik III rocket, Discoverer VI and Explorer IV are presented in the attached figures. *Subject Headings:* **1. Solar effects on upper atmosphere density 2. Upper atmosphere density variations 3. U. S. satellites 4. Soviet satellites.**—*E.K.* Ⓢ

11J–93 551.507.362.2:551.510.53:551.510.3:521.6

King-Hele, D. G. and Walker, (Mrs.) D. M. C. (*both, Royal Aircraft Establishment, Farnborough*), **Density of the upper atmosphere and its dependence on the sun, as revealed by satellite orbits.** *Nature*, London, 186(4729):928–931, June 18, 1960. 2 figs., 2 tables, 19 refs., 2 eqs. **DWB**—The study gives revised values for air density at heights between 180–700 km, deduced from satellite orbits, up to March 1960, and describes new features of the upper atmosphere. The wide variation of density between midnight and midday at heights above 500, which had previously been noted for one satellite, has now shown itself for five other satellites at heights between 180 and 250 km. The average air density seems to have decreased appreciably by perhaps 20%, between 1958 and 1960. Since it is known that day-to-day variations in air density depend on solar activity, this change is interpreted as the beginning of an 11 year cycle, with maximum density occurring at the sunspot maximum in 1957–58. At height above 250 km this effect should be more prominent. *Subject Headings:* **1. Upper atmosphere density variations 2. Satellite density measurements 3. Solar effects on upper atmosphere density.**—*E.K.* Ⓢ

11J–94 551.510.3:551.510.53:551.507.362.2

Kolegov, G. A., **Variatsii plotnosti verkhneĭ atmosfery po dannym ob izmenenii periodov obrashcheniia iskusstvennykh sputnikov Zemli.** [Variations in the density of the upper atmosphere according to data on the changes of rotation periods of artificial earth satellites.] *Iskusstvennye Sputniki Zemli*, Moscow, No. 4:31–34, **1960.** 1 fig., 5 refs., eq. **DLC**—Observations of artificial

satellite orbits have shown that their durations do not decrease monotonously in proportion to their descent into the atmosphere. From irregularities in the decrease of satellite orbit duration, atmospheric density variations can be inferred. In this paper a method of calculating such variations is described. Two curves showing daily variations of atmospheric density at 226 km as derived from observation of Sputniks 2 and 3 and carrier rockets of Sputniks 1 and 3 are presented. *Subject Headings:* **1. Upper atmosphere density variations 2. Satellite density measurements 3. Soviet satellites.**—*G.T.* Ⓢ

11J–95 551.501.7:551.507.362.2

Krasovskiĭ, V. I., **Issledovanie verkhneĭ atmosfery pri pomoshchi tret'ego iskusstvennogo sputnika Zemli.** [The exploration of the upper atmosphere by means of the third Soviet artificial earth satellite.] *Priroda*, Moscow, No. 12:71–78, Dec. **1958.** 6 figs. **DLC.** Transl. into English issued in *International Astronautical Congress, Amsterdam, Aug. 1958, Proceedings*, Vol. 2:614–625, issued **1959.** 9 figs., eqs. **DLC** (TL787.I44). Also transl. into English in *Institute of Radio Engineers, N. Y. Proceedings*, 47(2):289–296, Feb. **1959.** 19 figs. (incl. photos). **DLC**—The various fundamental geophysical problems which were unresolved before the ascent of the third Soviet artificial earth satellite are discussed. The various theories on the source of heat energy of the upper atmosphere, such as the absorption of sound waves from the troposphere, heating by interplanetary gases, and by electric currents of the ionosphere; the rocket model atmosphere indicating a cold isothermal region in the upper atmosphere; the allotropic character of the atmosphere; the diffusive separation of atoms and molecules in the earth's gravitational field; the ionization produced by micrometeorites, etc., are summarized. With the aid of ionizing micrometers it was shown that the thickness of the layer of the homogeneous atmosphere increased with height; at a height of 260 km the density of the atmosphere was 10^{-13} gr/cm^3 and at 355 km it was 9.10^{-15}/cm^3. By means of a Bennet mass spectrometer mounted on the third earth satellite it was shown that at heights above 250 km only atomic ions of oxygen and nitrogen are present but atomic ions of oxygen predominate. This indicates that the upper atmosphere above 250 km has an atomic composition. By means of an ultrashort wave dispersion interferometer it was demonstrated that the electron density at an elevation of 475 km is 1.0×10^6 electrons/cm^2, as against 1.8×10^6 electrons/cm^2 at 290 km. Observations during two revolutions of the satellite showed that at a height of 475 km on May 15, 1958, 5–6 hrs after midday, at moderate latitudes, the negative potential of the satellite relative to the environment was 6.4 volts, indicating an effective electron temperature of 15,000°K; the corresponding concentration of positive ions was 1.8×10^5/cm^3. At an elevation of 275 km the concentration of positive ions was 5.2×10^5 corresponding to an effective electron temperature of 7000°K. Electron velocities recorded by the satellite were close to the velocity of light so that these electrons cannot be primary solar particles. The apparatus for studying ionization, such as the ion trap, and for determining the concentration of positive ions, for recording heavy electrons, for recording the collision of micrometeorites, etc. is described with the aid of photographs and diagrams. Also a detailed diagram of the third earth satellite with the various instruments in place is included. *Subject Headings:* **1. Soviet satellite, 1958 Delta (Sputnik III) 2. Satellite instrumentation 3. Upper air observation techniques.**—*I.L.D.*

11J–96 551.507.362:551.510.53

Krasovskiĭ, V. I. (*Inst. of Physics of the Atmosphere, Academy of Sciences of the USSR*), **Results of scientific investigations made by Soviet Sputniks and cosmic rockets.** *Astronautica Acta*, Vienna, 6(1):32–47, **1960.** 15 figs., table. English, German and French summaries, p. 32. **DWB**—A survey is given of the results of Soviet investigation carried out by means of cosmic rockets and artificial satellites and in connection with it, hitherto unpublished information is given on measurements in the upper atmosphere and in cosmic space. The density of the atmosphere was found higher than expected. The density was greater by day than by night, greater in the polar than in the equatorial regions. Atmospheric ions were determined with a spectrometer. Upper atmosphere above 250 km showed an atomic structure. Intensities of cosmic rays were found to be a function of geomagnetic latitude. Hard ionized particles showed essential qualitative and quantitative differences between the equatorial and the polar zones. Powerful flux of the electrons was discovered in the upper atmosphere. Anomalies within the geomagnetic field were observed. The photo effect in the photomultiplier registered x-rays of energy of tens and hundreds kev. The piezo-electric elements registered micrometers. It was established that the magnetic field close to the surface of the moon does not exceed 50–100 g. *Subject Headings:* **1. Upper atmosphere density measurements 2. Upper atmosphere properties 3. Soviet satellites 4. Soviet cosmic rockets 5. Lunar magnetic field.**—*E.K.* Ⓢ

11J–97 551.507.362.2:551.508.4

Kuchaĭ, S. A., **Manometricheskaia pogreshnost', vyzyvaemaia malymi techami v obolochke sputnika.** [The manometer error caused by small leaks in the casing of a satellite.] *Iskusstvennye*

Sputniki Zemli, Moscow, No. 3:113–117, **1959.** 2 figs., eqs. **DLC, DWB.** Summary in *U. S. National Aeronautics and Space Administration, Technical Translations*, F-8:9–10, April **1960.** Complete transl., *Ibid.*, F-14, April **1960.** 7 p.—On the basis of assumptions concerning the source of leaks, the gaseous surroundings, and the laws pertaining to the scattering of molecules, a study is made of manometer errors caused by leaks in the casing of a satellite. The results permit formulation of qualitative requirements for sealing satellites to avoid excessive error. *Subject Heading:* **1. Satellite manometers.**—*Author's abstract.* Ⓢ

11J–98 551.507.362.2:551.510.53:551.510.3

Lidov, M. L., **Opredelenie plotnosti atmosfery po nabliudaemomu tormozheniiu pervykh iskusstvennykh sputnikov Zemli.** [Determination of atmospheric density from the observed deceleration of the first artificial earth satellites.] *Iskusstvennye Sputniki Zemli*, Moscow, No. 1:9–20, **1958.** 5 figs., 8 refs., 12 eqs. **DLC**—Transl. into English in *Artificial Earth Satellites*, N. Y. Plenum Press, Vol. 1, p. 10–24. **1960. DLC**—Near perigee the dependence of atmospheric density upon the height, Z, above the surface of the earth can be approximated by the formula $\rho = \rho_\pi e^{-\frac{Z-Z_\pi}{H}}$ where ρ_π = density at height of perigee, Z_π and H = height of a homogeneous atmosphere taken as constant. The application of this relationship to actual computation and the estimate of the possible errors associated with the variability of H with height Z are illustrated. Formulas are derived for computing and r_π and a simplified formula more suitable for computing is presented, namely

$$c\rho_\pi\sqrt{H} = -\frac{2}{3}\frac{(1-e)\sqrt{e}\,\frac{d\ln T}{dN}}{(1+e)\sqrt{2\pi r_\pi(1+e)}}$$

where c = ballistic coefficient, e = eccentricity, T = period of rotation, r_π = distance between center of earth and perigee and N = ordinal number of rotation. The results of calculation of ρ_π at different levels are presented in graphs, and in a table from data of the 1957 Sputniks are presented and analyzed. *Subject Headings:* **1. Upper atmosphere density measurements 2. Satellite density observations 3. Soviet satellites.**—*I.L.D.*

11J–99 551.521.3:551.507.362.2

London, Julius (*New York Univ.*), **Studies of atmospheric radiation as observed from satellites.** *U. S. Air Force. Cambridge Research Center, GRD Research Notes*, No. 36:109–114, June **1960.** fig., 4 eqs. **DWB**—A theoretical discussion of the radiative flux problem with a view to applying the results to forthcoming radiation measurements from satellites. The fundamental radiative transfer equation is discussed and a simple model for the "transparent" portion of the spectrum is formed. This model also permits some approximations of the intensity reaching the satellite from some nonvertical direction. *Subject Headings:* **1. Atmospheric radiation 2. Satellite radiation measurements.**—*I.S.* Ⓢ

11J–100 551.509.318:551.576.1

†Ludlam, F. H. and Miller, L. I., **Research on the properties of cloud systems.** London. Imperial College of Science and Technology. Dept. of Meteorology. Contract AF 61(514)-1292, Technical (Final) Report, March **1959.** 72 p. 17 figs., 2 tables, 29 refs.—In the first part of the report the use of cloud observations in modern forecasting practice is discussed. It is emphasized that cloud and weather are produced by atmospheric disturbances of greatly varying scale, and that whereas the large scale disturbances (horizontal dimension 1000 km or more and duration about a day or more) have a controlling influence over most weather, some significant weather is associated with disturbances of smaller scale. This fact should be recognized in designing the scope and the observational basis required for a particular forecast service. In extra-tropical regions the radiosonde network is sufficiently dense to allow the quantitative description and prediction of the large-scale disturbances, mainly in terms of the three-dimensional fields of pressure, temperature, and wind. The associated cloud and weather has with some justification not so far been regarded as an essential part of the description upon which prediction is based, and consequently there has been little incentive to develop techniques for the analysis and prediction of the properties of cloud systems (nephanalysis). It is concluded that new observational data on the extent of cloud systems, such as might be obtained from a satellite, are in these regions not likely to bring much benefit until they can conveniently be incorporated into a routine procedure for the analysis and prediction of the large-scale cloud and precipitation. On the other hand in other regions, especially in the tropics, nephanalysis can already lead to the improvement of the general analysis or may even be the only useful basis for analysis and prediction. Moreover, it is foreseen that as more experience and confidence is gained in the numerical computation of the large-scale disturbances, it will become more

desirable to develop methods for the quantitative prediction of the allied cloud and precipitation. Accordingly a review is made of the physical basis of cloud classification, as a preliminary to the separation of those properties which interest the large-scale analyst, and to the devising of codes and chart techniques to represent them. It is concluded that there is some justification for the division of clouds into low, medium-level and high clouds, but that from the point of view of the large-scale analysis a division into low clouds (associated with temperature change in the surface layer of air) and upper clouds (associated with large-scale upward motion in the troposphere) is sufficient. A tentative procedure for the analysis of these clouds is outlined, involving some alteration but not necessarily any lengthening of the reporting codes now in use. The important features of upper clouds and low layer clouds are their extent and the well-defined borders, and those of the cumuliform clouds are their amount and summit-levels. Isopleth representation of these features and of precipitation intensity is recommended and illustrated. In the later part of the report methods of forecasting the occurrence of high cloud systems are briefly discussed. A method using the apparent temperature advection in the 500–300 mb layer is recommended as simpler than and equally as useful as methods based on recognizing vorticity advection, and as capable of refinement. Ultimately a method involving machine computation of vertical displacements along 3-dimensional trajectories is likely to be the most satisfactory. One of the errors to which the simple method is liable is used to draw attention to some interesting features of high cloud systems in the neighborhood of jet streams which illustrate in the sky the existence of ageostrophic winds. *Subject Headings:* **1. Atmospheric circulation 2. Cloud movement 3. Satellite uses.**—*Authors' abstract.* Ⓢ

11J 101 551.501.81:551.577.1 551.507.362.2:551.576.1:778.3

Ludwig, F. L. and Nagle, R. E., **Cloud shield and radar precipitation echo relationships with satellite applications.** Stanford Research Institute, Menlo Park, California, Contract AF 19(604)-5982, Scientific Report No. 1, April **1960.** 97 p. 48 figs., 6 refs., eqs.—Fifteen mid-United States composite radarscope pictures are presented showing radar precipitation echoes, frontal positions, and total cloud cover. These are accompanied by analyses of the low, middle, and high cloud shields. Thirteen other composites from West Coast and Picket Ship pictures are presented in an Appendix. These latter are without cloud analyses. Three strip composites using radarscope pictures, taken during aircraft reconnaissance flights over the eastern Pacific, are included with their corresponding cloud and frontal analyses. The fifteen cloud-analyzed continental composites and the reconnaissance composites are discussed in the text with respect to the cloud-precipitation relationships. The probable character of satellite photographs is discussed. Characteristics of the cloud patterns which seem, from the composite analyses, to be associated with precipitation or storm systems are discussed in terms of the likelihood that they could be discerned from satellite photographs. *Subject Headings:* **1. Radar precipitation studies 2. Cloud formations 3. Satellite photography 4. United States.**—*Physics Abstracts.* Ⓢ

11J–102 551.507.362.2

McGuire, Frank G., **Weather satellite will have three cameras.** *Missiles and Rockets,* Wash., D. C., 5(9):17–18, March 2, **1959.** 2 photos. **DWB**—The U. S. Government announced that a satellite containing three television cameras will be launched into orbit in the first of a series of such meteorological experiments under the sponsorship of ARPA, and that later meteorological experiments will be the responsibility of the Weather Bureau Section. (*Same item as* 11.5–180, May 1960, *Met. Abstr.*) *Subject Heading:* **1. Satellite television observation techniques.**—*N.N.*

11J–103 551.507.362.2:551.521.17

†Mandel'shtam, S. L. and Efremov, A. I., **Issledovaniia korotkovolnovogo ultrafioletovogo izlucheniia solntsa.** [Investigation of short-wave ultraviolet solar radiation.] *Uspekhi Fizicheskikh Nauk,* Moscow, 63(1):163–180, Sept. **1957.** 13 figs., 5 tables, 24 refs. **DLC.** Transl. available LC or SLA. mi 2.70 phot. $4.80—The present paper sets out briefly the results of experimental and theoretical work on the study of the short-wave emission from the sun published since an earlier review (*Ibid.,* **1952**). Experiments are also described which, it is suggested, could be profitably carried out with the aid of an artificial-earth satellite. *Subject Headings:* **1. Ultraviolet solar radiation 2. Satellite uses.**—*Physics Abstracts.*

11J–104 551.507.362.2:551.510.53:551.510.3

Martin, H. A. and Priester, W. (*both, Sternwarte der Universität, Bonn*), **Measurement of solar and diurnal effects in the night atmosphere by artificial satellites.** *Nature,* London, 185(4713):600–601, Feb. 27, **1960.** 3 figs., 6 refs. **DWB**—A method is presented to separate the diurnal fluctuations from those of solar radiation in order to distinguish these effects in the high atmosphere by artificial satellites. The geocentric angular distance perigee-sun was used in comparison with the satellite data supposing the atmospheric density to be dependent on the differential of night ascension, of declination and the geocentric latitude of the perigee. In order to separate the diurnal effect

for the satellite 1958β2 the atmospheric density data were reduced to a standard value of the solar 20 cm radiation. The lines of constant density were determined by drawing the resulting values in a coordinate-system of differential night ascension and differential declination. The seasonal and the terrestrial effects being superposed, were deduced. Dependence of atmospheric density on night ascension is evident in the diurnal effects in the equatorial zone. A density model with solar and diurnal fluctuations for altitudes of 210, 350 and 660 km shows a large density fluctuation between day and night, suggesting a daily up and down movement of the atmosphere. These movements, decreasing with decreasing altitudes down to 200 km and becoming here insignificant compared with the fluctuation caused by solar radiation, indicate the origin of the latter in a layer below 200 km. This suggests that the absorption of solar X-ray radiation is responsible for these movements in the E layer of the ionosphere. The scale heights of the atmosphere and the ratio of temperature to mean molecular weight changes with the time of the day but very little with the flux of 20 cm radiation as shown by an equation. The diagrams illustrate the derivation of this result of the analysis. *Subject Headings:* **1. Solar radiation measurements 2. Air density 3. Diurnal variations.**—*O.T.* Ⓢ

11J–105 551.507.362.2:551.576.2

Merrill, Harrison J. (*U. S. Army Signal Res. and Development Laboratory, Fort Monmouth, N. J.*), **Cloud-cover observation and radiative measurements from a satellite.** *New York Academy of Sciences, Transactions*, Ser. 2, 21(2):153–158, Dec. **1958.** 6 refs. **DLC**—A satellite in a near-polar orbit at some elevations consistent with meteorological coverage could provide parameters that hitherto have not been available. Satellite sounding could improve immeasurably short range forecasting by providing: (1) timely essential data from areas, such as the North Pacific or the Arctic, where coverage is sparse and sporadic; (2) data on cloud fields from which global frontal movements can be deduced; (3) information of variation in particle and short wave ultraviolet and X-ray radiation so that their role in weather formation can be determined; (4) opportunities for measuring the effect of water vapor, dust and particles upon incoming solar radiation, radiation exchange of energy between earth and sun, effects of clouds upon the heat balance, etc. Measurement of the heat balance both in its total effect on the earth and its determination of modifying air masses and clouds is proposed by the Total Albedo Experiment (H. Wexler) and the Cloud-cover Experiment (V. F. Suomi). The heat balance provides a new parameter for synoptic charts so that medium and long range forecasting can be improved. Selective measurements in various regions of the electromagnetic spectrum can be made; the cloud cover at 10,000 feet and other altitudes can be mapped and compared with cloud cover and precipitation near the surface of the earth. The method of studying mass absorption of the atmosphere and its evaluation to determine the structure of the atmosphere, determination of the temperature on the surface of the earth by infrared detectors, etc. are discussed. *Subject Headings:* **1. Cloud cover 2. Radiative measurements 3. Satellite observations.**—*I.L.D.*

11J–106 551.506.22 550.3:061.3:629.19

Miczaika, G. R., **Das Internationale Geophysikalische Jahr, IV, "Projekt Vanguard." Der künstliche Erdsatellit und seine Bahn.** [The IGY, Pt. 4, Project Vanguard: the artificial satellite and its path.] *Umschau*, 57(7):193–195, April 1, **1957.** 5 figs. **DLC**—Properties of the atmosphere at a height of 500 km are summarized; improved data may be obtained with a satellite. Life has been variously calculated as a few days to a year. Launching mechanism and elliptical track are briefly described. (*Same item as* 8.7–80, July 1957, *Met. Abstr.*) *Subject Headings:* **1. Satellite observatories 2. IGY program.**—*C.E.P.B.*

11J–107 551.507.362.2:551.510.53:551.510.3

†Mikhnevich, V. V.; Danilin, B. S.; Repnev, A. I. et al. **Nekotorye rezul'taty opredeleniia strukturnykh parametrov atmosfery s pomoshch'iu tret'ego sovetskogo iskusstvennogo sputnika Zemli.** [Some results of the determination of the structural parameters of the atmosphere using the third Soviet artificial earth satellite.] *Iskusstvennye Sputniki Zemli*, Moscow, No. 3:84–97, **1959.** 11 figs., 3 tables, 37 refs. **DLC, DWB.** Summary in *U. S. National Aeronautics and Space Administration, Technical Translations*, F-8:8, April **1960.** Complete transl., *Ibid.*, F-13, April **1960.** 19 p.—This paper presents a study of a part of the results of the determination of the density of the atmosphere, which were obtained from manometer measurements on the third Soviet artificial satellite. *Subject Headings:* **1. Upper atmosphere density measurements 2. Soviet satellite, 1958 Delta (Sputnik III). I. Sokolov, V. A.**—*Authors' abstract.* Ⓢ

11J–108 550.3:681.14:621.38 551.509:551.507.362.2

Minnis, C. M., **Automatic reduction of geophysical data.** *Nature*, London, 183(4669):1166–1168, April 25, **1959. DWB**—Account of the discussion organized by the Royal Astronomical Society and held Jan. 23, 1959. Digital computers as applied to several geophysical disciplines are summarized here. Weather forecasting in relation to earth satellites with the object of constructing

continental contour maps—accurately representing observational data, and numerical forecasting at large—is well adapted for automatic processing though adequate techniques are in the matrix stage. *Subject Headings:* **1. Weather forecasting 2. Satellite uses.**—*W.N.* Ⓢ

11J–109 551.510.536 551.510.3:551.507.362.2

*†Minzner, R. A.; Champion, K. S. W. and Pond, H. L., **The ARDC Model Atmosphere, 1959.** *U. S. Air Force. Cambridge Research Center, Air Force Surveys in Geophysics*, No. 115, Aug. **1959.** 137 p. 11 figs., numerous tables, 46 refs., 36 eqs. **DWB, DLC**—A model of the earth's atmosphere to 700 km is given. Below 53 km the present model is the same as the ARDC Model Atmosphere 1956. Above this height, changes have been made based on data deduced from rocket flights and from the rate of change of the orbital period of satellites. At approximately 600 km the new model gives densities that are 20 times higher than the 1956 model. Below 600 km the two models gradually come closer together and finally cross at about 150 km. Between 90 and 150 km the density for the 1959 model is lower, being about one half that of the 1956 model at 120 km. At the present time, the maximum altitude at which density data from satellites has been obtained is just below 700 km. For this reason, the tables end at 700 km. Dashed lines in the plots present a tentative extrapolation of the data to 1000 km. The value of the molecular weight, like other atmospheric properties, probably depends on both location and time. The 1959 model curve probably represents the molecular weight at high latitudes, such as Fort Churchill, where the experimental data were obtained. At lower latitudes the molecular weight may be nearer the curve given in the 1956 model. (*Same item as* 11.8–178, Aug. 1960, *Met. Abstr.*) *Subject Headings:* **1. Exosphere 2. ARDC model atmosphere.**—*Authors' abstract.* Ⓢ

11J–110 551.508.85:551.507.362.2

Mook, Conrad P. (*Diamond Ordnance Fuze Labs, Wash., D. C.*) and Johnson, David S. (*U. S. W. B.*), **Proposed weather radar and beacon system for use with meteorological earth satellites.** Reprint from 1959 Conference Proceedings, 3rd National Convention on Military Electronics, Institute of Radio Engineers, Professional Group on Military Electronics. [**1959.**] p. 206–209. 2 figs., 4 refs., 2 eqs. **DWB** (M08.77 M817pro)—Resolution, wave length selection, receiver sensitivity, power and antenna requirements are some of the factors that must be taken into consideration in designing a meteorological satellite radar system. These five factors are discussed in terms of application to rainfall return. It is concluded that a satellite-mounted radar is much preferred to other satellite weather surveillance systems. It provides three dimensional synoptic coverage of world-wide rainfall patterns on a round-the-clock basis. Other surface weather elements such as pressure and wind can also be read from remote automatic beacon type weather stations. *Subject Headings:* **1. Radar rainfall measurement 2. Radarsondes 3. Weather satellites.**—*N.N.* Ⓢ

11J–111 551.507.362.2:551.508

Mowbray, Lionel, **Mesures réalisables par les satellites.** [Measurements workable by means of satellites.] *La Nature*, Paris, 3273:29–34, Jan. **1958.** 6 figs. **DLC**—Distinction between satellites and sonde rockets, the latter offering certain peculiar possibilities, namely as concerns the exploration of the lower layers of the atmosphere. Satellites enlarge considerably the scope of knowledges on the spatial phenomena as well in space as in time. The author reviews the instruments capable of being carried aloft and the measurements made with satellites, geographical measurements, measurements of the globe's flatness, density of high atmosphere, denseness of ions, cosmic rays, terrestrial and spatial magnetic field, Sun's ultraviolet radiation, global radiation of Sun or Earth, etc. *Subject Headings:* **1. Satellites observatories 2. Satellite instrumentation.**—*A.V.*

11J–112 551.507.362.2

Fourth artificial earth satellite (1958β). *Nature*, London, 181(4612):810, March 22, **1958. DWB**—On March 17, 1958 the U. S. Navy launched another artificial earth satellite at Cape Canaveral, Fla. by means of a "Vanguard" rocket. The satellite, 1958β, consisted of an aluminum sphere 6.4 in. in diameter; mass, 3.25 lb.; eccentric orbital revolution, 400 and 2,500 mi above the earth's surface; time, 135 min. The satellite is equipped with two radio transmitters, one powered by chemical batteries, broadcasting on a frequency of 108.00 mc/sec, the other, powered by solar batteries, operating on 108.30 mc/sec. *Subject Heading:* **1. U. S. satellite, 1958 Beta (Vanguard I).** —*N.N.*

11J–113 551.5:061.3:551.507.362.2

Le 3e Congrès de la Météorologie Mondiale a envisagé l'utilisation des satellites artificiels. [The third World Meteorological Congress has considered the use of artificial satellites.] *La Nature*, Paris, No. 3290:253, June **1959. DLC**—Short account of the 3d Congress of the World Meteorological Organization, held at Geneva from April 1–28, 1959. The agenda of the third Congress included scientific items, those offering greatest present interest being: extra-atmospheric

space and artificial satellites, meteorology and atomic energy, economics of water and hydrology, meteorology of arid zones, results to be expected from the International Geophysical Year. Measurements of variables belonging to physics of the atmosphere are likely to be made by means of the artificial satellites; they are, principally: measurements of direct solar radiation and albedo of the earth, clouds, atmosphere, global infrared radiation, measurements of the water-vapor spectrum, global precipitations measurements by means of radar, approximate vertical distribution of temperature, mass of the atmosphere, etc. Satellites will not put an end to the classical methods actually in use. It will furthermore be necessary to fill in the gaps between the maximum altitude of sounding-balloons and the extra-atmospheric space through suitable means, such as meteorological rockets, regularly launched from a certain number of selected points. *Subject Headings:* **1. WMO congresses 2. Satellite uses 3. Geneva.**—*A.V.* ⑤

11J–114 551.502.362.2:551.508

Zum zweiten künstlichen Erdsatelliten. [Second artificial earth satellite.] *Naturwissenschaftliche Rundschau*, Stuttgart, 11(1):20–21, Jan. **1958.** 6 photos. **DWB, DLC**—A series of illustrations showing the instrumentation of Sputnik II. They include a diagram of the arrangement of the instruments, illustrate the outward appearance of the earth satellite (ultra-violet and X-ray measuring instruments, hermetically sealed cabin with dog), and photographs of the container with the scientific instruments in the satellite, instrument for studying solar radiation, the dog "Laika" in the pressure chamber and instrument for studying cosmic radiation. *Subject Headings:* **1. Satellite observatories 2. Soviet satellite, 1957 Beta (Sputnik II) 3. Satellite instrumentation.** —*I.L.D.*

11J–115 551.507.362.2:551.508

Der Amerikanische künstliche Erdsatellit 1958 Alpha. [American artificial earth satellite 1958 Alpha.] *Naturwissenschaftliche Rundschau*, Stuttgart, 11(3):102, March **1958.** fig. **DWB, DLC**—A description of the rocket and satellite Alpha which was shot into space Jan. 31, 1958 including the rocket, structure and dimensions of the satellite, instrumentation, location of the tracking stations, orbit, etc. A graph showing the comparative maximum and minimum orbital distances, and weights of Sputnik I and II and of Explorer I, is presented. *Subject Heading:* **1. U. S. satellite, 1958 Alpha (Explorer I).**—*I.L.D.*

11J–116 551.507.362.2:550.3:061.3

Newell, Homer E., Jr. (*Naval Res. Lab., Wash., D. C.*), **International Geophysical Year earth satellite program.** *Franklin Institute, Phil., Journal of the Franklin Institute Monographs*, No. 2:2–13, June **1956. DWB**—Details of Project Vanguard, including instrumentation of vehicle by Navy Research Lab., the 11 ton launching vehicle being constructed by Glenn L. Martin Co.; orbit, 3 stage performance, optical and radio observing program, computational centers; and geophysical or astrophysical problems which may be solved by the earth satellite program are discussed in this article. (*Same item as* 9.4–45, April 1958, *Met. Abstr.*) *Subject Headings:* **1. Project Vanguard 2. IGY satellite program.**—*M.R.*

11J–117 551.507.362,2:551.506.22

Newell, Homer E., Jr. (*U. S. Naval Research Lab.*), **International Geophysical Year earth satellite program.** *Scientific Monthly*, Wash., D. C., 83(1):13–21, July **1956.** 17 refs. **DWB, DLC**—The author sums up briefly the general program of the IGY and the significance of the satellite program within the overall program and then considers the physical properties of an artificial satellite, including the nature of its orbit and its relationship to the earth, the technical problems involved in the creation of an artificial satellite such as its launching into space, the uses of the satellite in meteorology, geodesy, etc., the instrumentation of the satellite and such satellite experiments as measurements of the earth, magnetic field above the E-region of the atmosphere, direct observation of the sun in the Lyman spectrum by means of photon counters, etc. (*Same item as* 9.7–68, July 1958, *Met. Abstr.*) *Subject Heading:* **1. IGY satellite program.**—*I.L.D.*

11J–118 551.507.362.2:551.506.22

Newell, Homer E., Jr., **Some preparations for the International Geophysical Year earth satellite program.** *American Geophysical Union, Transactions*, 38(4):450–456, Aug. **1957. DWB, DLC**—If all goes as planned, a number of small artificial satellites of the earth will be launched during the IGY. The IGY satellites will be launched by means of a finless three-staged rocket weighing about 11 tons. The satellites will be small, weighing on the order of 21.5 pounds. To make the utmost use of this small weight, the instrumentation must be miniaturized as much as possible, using such things as transistors and ferrite cores, and the most efficient power-supply systems obtainable. Nevertheless, there is a considerable list of worthwhile experiments that might be done in such a small satellite, including observations of solar radiation, cosmic rays, the earth's magnetic field,

the ratio of radiation influx to the atmosphere to the radiation efflux, micrometeors and dust in space, the cloud cover over the earth, auroral particles, the density of the upper atmosphere, and geodetic parameters. The first four experiments have already been selected by the Technical Panel for the Earth Satellite Program to be attempted during the IGY. Since the last two listed require only careful observation of the satellite's motion, they will certainly be done also. The initial IGY satellites will open a new frontier of science, of engineering, and of man's achievement. The future possibilities of research from such space vehicles are exciting to contemplate, particularly in the light of possible increases in total payload weight, and increased flexibility in the choice of orbital inclinations and altitudes. (*Same item as* 9.5–57, May 1958, *Met. Abstr.*) *Subject Headings:* **1. IGY satellite program 2. Satellite observatories.**—*Author's abstract.*

11J–119 551.506.22 551.5:550.3:061.3

Newell, Homer E., Jr and Townsend, J. W., Jr. (*both, U. S. Naval Research Lab.*) **IGY Conference in Moscow.** *Science*, N. Y., 129(3341):79–84, Jan. 9, **1959.** 4 figs. (incl. photos), 2 tables, 15 refs. **DLC**—The Fifth General Assembly of CSAGI was held in Moscow from July 30 to Aug. 9, 1958. Among other things the Assembly decided that 1) IGY will terminate on Dec. 31, 1958; 2) IGY will be followed by "International Geophysical Cooperation (IGC), 1959," and 3) CSAGI will cease to exist. It was also agreed that a complete record of IGY will be published in the form of **Annals** of IGY. During the symposia, which reviewed the accomplishments of IGY during its first year, the U.S.S.R. impressively reported its accomplishments in the rocket and satellite area. The Soviet experiments mainly concentrated on: a) Distribution of electron density and the nature and number of positive ions and b) Temperature distribution up to an altitude of 50 kms and the study of cosmic rays and photons. The article summarizes the techniques of Soviet experiments and outlines the results. Soviet and U. S. data is compared, summarized and graphically combined. *Subject Headings:* **1. IGY conferences 2. Soviet participation in IGY 3. Moscow, U.S.S.R.**—*I.S.* Ⓢ

11J–120 551.507.362:629.19

Newell, Homer E. (*Nat. Aeronaut. and Space Admin., Wash., D. C.*), **Capabilities for space research.** *Journal of Geophysical Research*, Wash., D. C., 64(11):1695–1712, Nov. **1959.** 13 figs. **DLC**—A survey of the space research planning of the National Aeronautics and Space Administration. The paper presents fine description and illustration of today's space vehicles and vehicles soon to be available. Advanced boosters under construction, payload growth for different missions, the study of the atmosphere and ionosphere, the study of energetic particles and the great radiation belts, effects associated with magnetism, electricity and gravity are discussed. *Subject Headings:* **1. Space research 2. Space vehicles.**—*E.K.* Ⓢ

11J–121 551.510.3:551.510.535:551.524.7

Nicolet, Marcel, **High atmosphere densities.** *Science*, Wash., D. C., 127(3310):1317–1320, June **1958.** Also issued as: *Belgium Institut Royal Météorologique, Contributions*, No. 41, **1958.** 5 figs., 18 refs. **DLC**—This article shows how the concept of the thermosphere must be considered, according to the view of CHAPMAN on the extension of the corona toward the earth's atmosphere and according to the atmospheric structure determined by the author, who introduced diffusion distributions for all constituents at altitudes above 110 km. The atmospheric models of the thermosphere that neglect diffusion cannot explain ionospheric and satellite observations. The dissociation of molecular nitrogen cannot be introduced to decrease the mean molecular mass. The oxygen-nitrogen ratio cannot be considered as constant. An atmospheric model must be founded on heat transport such as suggested by CHAPMAN. It is possible to estimate temperatures and temperature gradients in the neighborhood of 500 km and, consequently, conservative values of densities, if various values of the heat conduction are adopted. (*Same item as* 10.5–199, May 1959, *Met. Abstr.*) *Subject Headings:* **1. Upper atmosphere densities 2. Thermosphere 3. Satellite observations 4. Upper air temperatures.**—*A.V.*

11J–122 551.510.536:551.594.13 551.507.362.2:551.506.22

Nicolet, M., **Nouvelles de l'espace.** [Space news.] *Ciel et Terre*, Brussels, 75(3/4):91–107, March/April **1959.** 4 figs. **DLC**—Account of the results obtained by means of artificial satellites during the International Geophysical Year as concerns high atmosphere. First of all, author discusses dissociation and recombination of oxygen and nitrogen molecules in upper atmosphere, where motions of charged particles are bound to the earth's magnetic field. A table shows the main peculiarities of the satellites launched up to March 1959. Diminution of satellite's orbit, owing to decrease of speed caused by atmospheric density, is discussed. The proportion of change in satellite's orbit shows that the irregularities in density of air result principally from fluctuations in solar radiation. Data relating to the changes in density within thermosphere and influence of the rise of temperature upon the increase in density are given. Densities observed and their fluctuations show that the thermal gradient at 150 km is $>10°$ per km and may reach values such as 30° and 40°

per km. Results obtained by means of satellites and whistlers show that ionization decreases very slowly with altitude beyond the maximum, in the range of 10^6 electrons per cm^3, of the F2 region. They show that there is no propagation about the equator and that the phenomenon follows the lines of force going from one hemisphere to the other. Comments on the artificial geomagnetic and radioelectric effects caused through thermonuclear explosions, and more particularly on the artificial creation of temporary radiation zones at altitudes of 10,000 km or so are included. (*Same item as* 11.4–150, April 1960, *Met. Abstr.*) *Subject Headings:* **1. Upper atmosphere 2. Atmospheric density 3. Dissociation and recombination of oxygen and nitrogen molecules 4. Ionization 5. Satellite observations 6. IGY, 1957–1958.**—*A.V.*

11J–123 551.507.362:551.508

†Ordway, F. I., III (*General Astronautics Corp., N. Y.*), **Instrumentation of artificial satellites.** *Astronautica Acta*, Vienna, 4(1):90–110, **1958.** 21 figs., 53 refs. **DWB**—This investigation is mainly on the different instruments installed in rockets and in earth satellites. Some four new instrument packages have been developed, laboratory tested and approved. A description of each of these is included, plus some descriptive work on meteoric erosion experiments, cosmic ray observations, the investigation of the radiation balance of the earth, the measurement of interplanetary matter and the satellite environmental measurements of pressure, temperature, meteoric incidence and skin erosion. (*Same item as* 10.6 92, June 1959, *Met. Abstr.*) *Subject Headings:* **1. Satellite instrumentation 2. Rocket instrumentation.**—*N.N.*

11J–124 551.507.362.2

Osgood, Carl C. (*RCA Astro-Electronic Products Div., Princeton, N. J.*), **Structural design of Tiros I.** *Astronautics*, N. Y., 5(6):42–43, 90–91, June **1960.** Figs. **DLC**—The structural design of Tiros I is briefly described. The satellite's special requirements led to the use of a completely strain-controlled structure employing riveted aluminum-alloy rib and sheet and special surface coats. Diagrams show the Lower-Plate assembly layout, the installation of payload on rocket and a side-view showing hubs. Photographs show basic structure, with several panels removed to show the upper ribbing and surface and the static load test setup. The results of vibration analysis are plotted. *Subject Headings:* **1. Satellite design 2. U. S. satellite, 1960 Beta (Tiros I).**—*E.Z.S.* Ⓢ

11J–125 551.507.362.2

Akademiebericht über die Erdsatelliten. [Academy report on the artificial satellites.] *Osteuropa-Naturwissenschaft*, Stuttgart, 1(2):155–156, May **1958. DWB**—A statement made by A. W. Topchev at the annual meeting of the Academy of Sciences of the USSR on March 26, 1958, is quoted from the newspaper Pravda of the same date. The statement refers to preliminary results of atmospheric density, ionospheric electron density, radio propagation, cosmic radiation and biological observations made by means of the first two Soviet Satellites. *Subject Headings:* **1. Satellite uses 2. Upper atmosphere research 3. Soviet satellites.**—*G.T.*

11J–126 551.507.362.2

Paetzold, H. K., **Die ersten künstlichen Erdsatelliten (Das Internationale Geophysikalische Jahr, XIII).** [The first artificial earth satellites (The International Geophysical Year, Pt. 13).] *Die Umschau*, Frankfurt a.M., No. 1:3–7, **1958.** 7 figs. **DWB, DLC**—Details of the first two Soviet satellites, their trajectories, tracking and variations are discussed, along with the first preliminary scientific results. It appears that atmospheric density at 200–250 km is about double the value assumed in the past. Radio signals are being received from satellites far below the horizon which would indicate that radio waves are channeled along the ionosphere for some time before penetrating into the lower atmosphere. (*Same item as* 10.7–92, July 1959, *Met. Abstr.*) *Subject Headings:* **1. Satellite laboratories 2. Soviet satellite, 1957 Alpha (Sputnik I) 3. Soviet satellite, 1957 Beta (Sputnik II).**—*G.T.*

11J–127 551.506.7:551.510.536

Paetzold, H. K. (*Max-Planck-Inst. für Aeronomie, Inst. für Stratosphären-Physik, Weissenau, und Technische Hochschule München*), **Einige Ergebnisse aus den Beobachtungen der ersten russischen Erdsatelliten.** [Some results of the observations of the first Russian artificial satellites.] *Raketentechnik und Raumfahrtforschung*, Stuttgart, 2:50–54, April **1958.** 7 figs., table, 4 refs., 3 eqs. **DLC.** Also his: **Weitere Beobachtungen der russischen Erdsatelliten.** [Further observations of the Russian earth satellites.] *Ibid.*, 3(2):45–49, April/June **1959.** 6 figs., table, 14 refs. **DLC, DWB** (629.1388 P126ei)—The orbits of the satellites 1957 α_1 and α_2 and β and 1958α are tabulated and briefly discussed. The succeeding theoretical discussion of the state of the upper atmosphere is based on visual and radio signal observations at different locations in Germany. Some of the results are that (1) the density of air at very great heights is by far higher than assumed. (2) The surface at immediate right angle to direction of movement rather than any aerodynamic effects

of the shape of a satellite is what should be considered in quantitative evaluation. (3) The impact of colliding air-molecules with a satellite is assumed to be "elastic" (i.e. the former sticks before thermally evaporated). Ionospheric radio relationships are also touched upon. The results are presented graphically. Further observations and measurements, especially with Sputnik III, have been made since the first report on measurements with the first Russian earth satellite one year ago. The radio signals of this satellite have been received through 9 months. The results described concern mainly the propagation of electromagnetic waves in the ionosphere and the structure of the upper atmosphere. *Subject Headings:* **1. Satellite observational data 2. Upper air observation techniques 3. Soviet satellites.**—*W.N. & E.K.*

11J–128 551.510.536:551.510.3:551.507.362.2

Paetzold, H. K. and Zschörner, H., **Die Dichte der äussersten Erdatmosphäre nach Satellitenbeobachtungen.** [The density of the exosphere according to satellite observations.] *Die Naturwissenschaften*, Berlin, 45(20): 485–486, Oct. 15, **1958.** 2 figs., table, 7 refs., 2 eqs. **DLC**—The density of the atmosphere at 200 km has been more exactly observed after the launching of artificial satellites. After the launching of the Sputnik I and Sputnik II, the observed density at 225 km was quadruple the value observed by rockets. In a table, the authors give the characteristic data of the satellites and also the evolution of the air density is given after launching of Sputnik I and II. Temporary variations of temperature, density of the high terrestrial atmosphere are to be considered, because there is a fluctuation in the deposits of interplanetary material. The observations show that fluctuation of density over a period of one or more days is not going higher than the amplitude of ±20%. (*Same item as* 10.7–97, July 1959, *Met. Abstr.*) *Subject Headings:* **1. Air density 2. Exosphere 3. Satellite observations.**—*A.V.*

11J–129 551.507.362.2:551.510.3:551.510.53 551.510.535:551.594.12:551.510.62

Paetzold, H. K. (*Max-Planck-Institut für Aeronomie, Institut für Stratosphären-Physik, Weissenau and T. H. München*), **Die höchste Atmosphäre und der Weltenraum.** [The highest atmosphere and the cosmos.] *Umschau*, Frankfurt a. Main, 59(1):3–6, Jan. 1, **1959.** 5 figs., table. **DLC**—The audibility of the Sputnik radio signals of 20 MHz and 40 MHz indicated that the radio waves were refracted in the ionosphere; this is possible only when the electron density does not fall below a value of 1.10^6 electrons/cm³ in the maximum of the ionosphere at a height of 300 km. At greater altitudes the electron density siminishes much more gradually than the atmospheric density. The relative ionization gradually increases with altitude from 0.05% at 300 km to 7% at 1000 km. From the Faraday frequency perceptible in the satellite signals it was possible to compute an electron density of 5.10^5 electrons/cm³ at 500 km. The temporary and irregular fading indicates the existence of ionospheric inhomogeneities. Duration of fading of several minutes to several seconds indicated horizontal variations of electron density extending from 2000 km to 100 km. The satellite became inaudible over higher latitudes at relative close distance while from the south it was audible at great distances; this indicates the influence of the polar ionosphere which is more disturbed by incursion of corpuscle clouds than in lower latitudes. The shorter life of the satellites as a result of deceleration indicates that atmospheric densities above 200 km are higher than hitherto expected. These higher densities signify higher temperatures in the upper atmosphere. At 200, 350 and 1000 km the temperatures were 800, 2000 and 2500°K, respectively. The composition of the atmosphere comprises a density of 100 nitrogen molecules/cm³ and 1×10^6 oxygen atoms/cm³, and 0.1% atomic hydrogen at about 80 km. At 1000 km there are still 10^5 H-atoms/cm³ and at 3000 km 1000 H-atoms/cm³ may be present. At the high temperatures of the exosphere H-atoms are no longer stable but evaporate into the cosmos. Atmosphere density is greater by day than at night; variations in density amounting to a factor of 10 result from a warming up of the high atmosphere. The frequency of meteorites impinging upon the satellite was 1 meteorite/100m² sec for meteorites 4μ in diameter; with increasing size the frequency diminished by a factor of 10. The cosmic radiation was extraordinarily high; at 1000 km it was 1000 times greater than the normal cosmic radiation. The radiation particles were protons. The maximum of radiation is apparently at 10,000 km and above this height it diminishes. The origin of the radiation belt is discussed. *Subject Headings:* **1. Ionospheric radio wave refraction 2. Ionospheric ionization 3. Satellite observation at the upper atmosphere 4. Upper atmosphere densities.**—*I.L.D.* Ⓢ

11J–130 551.510.3:551.510.53:551.507.362.2

Paetzold, H. K. and Zschörner, H., **Über Dichteschwankungen der höchsten Atmosphäre nach Satellitenmessungen.** [Density variations of the highest atmosphere according to satellite measurements.] 4 p. 3 figs. Reproduction of typescript (1959) **DWB** (629.1388 P126ub)—Observations of satellites Explorer V, Sputnik III, and Vanguard I at the Telefunken Co. (20 mc) and elsewhere show that the density of the air during the day is 20% higher than at night at 225 km, with extreme values in the evening and the morning, respectively, and the density also decreases from the high latitudes to the equator. Relation of density to solar activity, magnetic storms, solar UV, etc.,

are also considered but not established, and data presented graphically to illustrate. *Subject Headings:* **1. Satellite density observations 2. Upper atmosphere densities (225–650 km) 3. Soviet satellite, 1958 Delta (Sputnik III) 4. U. S. satellite, 1958 Beta (Vanguard I).**—*M.R.* Ⓢ

11J–131 551.510.536:551.507.362.2

*Paetzold, H. K. (*Max-Planck-Inst. of Aeronomy, Inst. of Physics of the Stratosphere, Weissenau*), **Observations of the Russian satellites and the structure of the outer terrestrial atmosphere.** *Planetary and Space Science*, N. Y., 1(2):115–124, April **1959.** 8 figs., table, 24 refs., 9 eqs. **DWB**—The launching of the artificial earth satellites gave the opportunity to gain some direct information about the outer region of the earth's atmosphere. Our radio observations were mostly made on 20 MHz with a new direction-finder developed by the firm Telefunken in Ulm. This instrument uses three pairs of adcock-antennas. The direction of the wave front and the amplitude of the received signals can be measured at the front of a television tube. A movie-camera registers the pictures with a time resolution of 0.1 sec. The accuracy of the measured azimuths is about 0.5°. For 1957α, 1957β and 1958δ, optical observations of the German Moonwatch-groups were used. Further orbit data were obtained from the Moonwatch Headquarters, Cambridge, Mass., the Air Force Cambridge Research Center, Bedford, Mass., and the Vanguard Computing Center, Washington. *Subject Headings:* **1. Outer atmosphere structure 2. Satellite observations 3. Soviet satellites.**—*Author's abstract.* Ⓢ

11J–132 551.507.362.2:551.510.53

†Paetzold, H. K., **Die oberste Erdatmosphäre nach Satellitenmessungen.** [The upper atmosphere seen from satellite observations.] *Die Naturwissenschaften*, Berlin, 46(13):416–422, July 15, **1959.** 7 figs., 3 tables, 46 refs. **DLC**—With the aid of artificial earth satellites, it is possible to study the ionosphere situated above the F2-peak level. In particular, the frequencies used in the Soviet satellites (20 and 40 Mc/s) gave interesting results according to which the electron density seems to decrease slowly above the F2 layer. Fading observed in the reception of these radio signals indicates the presence of heterogeneities in the ionization, particularly in the polar zones. For the explanation of a kind of periodic fading, it is necessary to consider the rotation of the satellite and of the antennas and also the influence of the geomagnetic field. Temperature and density values of the upper atmosphere can be deduced from the observation of the deceleration of artificial satellites. The temperature at 1000 km is in the range of 2000°K, a value suitable to explain the escape of helium. Oscillations of the value of the deceleration are associated with local variations of density and temperature. The discovery of the Van Allen radiation belts, where particles are trapped in the geomagnetic field, is due to the cosmic ray equipment of earth satellites. The "Argus" experiment (explosion of A bombs at an altitude of 500 km) showed the possibility of creating temporary radiation belts observed between the two natural belts by satellites then in orbit. (*Same item as* 11.2–80, Feb. 1960, *Met. Abstr.*) *Subject Headings:* **1. Upper atmosphere 2. F layers 3. Electron density 4. Satellite observation of the upper atmosphere.**—*A.V.* Ⓢ

11J–133 551.506.7:551.507.362.2

*Petri, Winfried (*Schliersee/Obb*), **Auf der Schwelle des Weltraums: bericht über die ersten Wochen der künstlichen Erdsatelliten (Sputniki) 1957α_1 α_2 und β.** [At the threshold of outer space: Report on the first week of artificial earth satellites (Sputniks) 1957α_1, α_2 and β.] *Naturwissenschaftliche Rundschau*, Stuttgart, 11(1):1–7, Jan. **1958.** 7 figs., 5 tables, eqs. **DWB, DLC**—The author summarizes Soviet studies on experimental rockets appearing in the Soviet literature prior to the launching of Sputnik I and II, including description of the structure of the rockets, indication of satellite launching and various information on the instrumentation for obtaining data on outer space and on the duration of the recording and transmission time. This is followed by a discussion of the celestial mechanics of satellites close to the earth, the influence of gravity upon the satellite path, the effect of precession upon the rotation of the plane of the path, the rotation of the opsidal lines, the braking action of atmospheric density upon the path, etc.; the visual observation methods employed to track the satellite, namely: "moon watch"; various problems in determining the time of revolution of the satellite by visual means; reception of signals from the satellite radio by "Minitrack"; the radio interferometer technique; evaluation of the radio signals and lunar echoes from the Sputnik. Diagrams showing the motion of Sputnik within 24 hrs, a comparison of the paths of the first two satellites, and graphs showing the variation of atmospheric pressure with altitude according to Soviet data, U. S. data and the standard atmosphere, satellite path at 530 km, variation of reception frequency as a function of time, and variation in the revolution period of satellite α_2 and numerical data on the first two satellites. *Subject Headings:* **1. Satellite observational data 2. Soviet satellite, 1957 Alpha (Sputnik I) 3. Soviet satellite, 1957 Beta (Sputnik II).**—*I.L.D.*

11J–134 551.507.362.2:551.510.536:523.51

Petri, W. (*Schliersee/Obb.*) and Faust, H. (*Offenbach*), **Neue Satelliten-Ergebnisse.** [New satellite findings.] *Naturwissenschaftliche Rundschau*, Stuttgart, 11(12):460–461, Dec. **1958.**

fig. **DWB, DLC**—There are four brief notes entitled: (1) **Density variation of the upper atmosphere.** G. HERGNHAHN discovered that orbital period of Sputnik 2 and Sputnik 3 decreased (up to 40%) rather than increased. The discovery was made while analyzing the Doppler effects of the satellite-borne radios. The phenomenon may be due to a drop of 25 km of the atmosphere, or less plausible, less air friction due to self-orientation of the cone shaped satellite exposing least resistance surface. (2) **Micrometeorites.** The 10 kg Vanguard, fired May 27, 1958, reached about 3000 km altitude and was hit by 17 micrometeorites during ten minutes. Assuming that these figures are representative, the earth is bombarded at least five times heavier than was believed. (3) **Contour of the earth.** U. S. 1958 Alpha and Beta 2 satellite observations show that the earth is not as flat as assumed. The difference is 200 m in favor of the polar diameter vs. the equatorial. The observations of U.S.S.R. satellite, 1957 Beta, made by the English Air Force Research Establishment at Farnborough found the earth oblateness to be 1/298.1 rather than 1/297.1. (4) **State of the upper atmospheric layers on bases of satellite measurements.** PAETZOLD'S remarkable results showing a very active dynamic of the upper atmosphere were arrived at with the aid of Sputnik 1 and Sputnik 3. Electron density, ionization, air density and temperatures are briefly discussed. The density of air at 225 km altitude above the equator is only half of the density of the air above the pole. The density and temperature decline from the pole toward the equator is associated with strong E-W winds. *Subject Headings:* **1. Upper atmosphere density variations 2. Micrometeorites 3. Earths' oblateness 4. U. S. satellites 5. Soviet satellites.**—*W.N.*

11J–135 551.507.362.2

Petri, Winfried (*Munich*), **Satelliten überraschen die Wissenschaft.** [Satellites astonish science.] *Naturwissenschaftliche Rundschau*, Stuttgart, 12(5):175 180, May **1959.** 8 figs. **DWB, DLC**—The amazing and often surprising results gained by artificial satellites are summarized. Radio observations inform us about the location, range, rotation effects, electron density and electrical charge of clouds. Orbit disturbances offer a better knowledge of air density, the shape of the earth (asymmetric, slightly pear-shaped), side winds, density and temperature oscillations, and the structure of the air. Radiation measurements present clues to geomagnetic effects, light and heavy elements, electrons and radiation belts. One of the diagrams illustrates the density of the air above 200 km. *Subject Heading:* **1. Satellite observations.**—*O.T.* Ⓢ

11J–136 551.507.362.2:551.510.535:551.521.64

Pravda, Moscow, **Soviet artificial earth satellites: some results of the scientific investigations carried out by the two first Soviet sputniks.** Transl. of original Russian in *Pravda*, April 27, **1958.** 12p. Reproduction of typescript. **DWB** (629.1388 S729)—From the successful launching of sputniks by the U.S.S.R. during 1957, scientists have been better able to study the upper atmosphere and cosmic space. Results of ionospheric and cosmic rays investigations have been obtained from the data transmitted from these sputniks. This paper discusses also the results of the medico-biological investigation of Sputnik II. The major part of the report is the analysis of the results of these satellites. (*Same item as* 11.2–35, Feb. 1960, *Met. Abstr.*) *Subject Headings:* **1. Satellite observations 2. Soviet satellites. 3. Upper air observations 4. Cosmic radiation 5. U.S.S.R.** —*N.N.*

11J–137 551.507.362:621.396

*Priester, Wolfgang; Bennewitz, Hans-Gerhard and Lengrüsser, Peter, **Radiobeobachtungen des ersten künstlichen Erdsatelliten.** [Radio observations of the first artificial satellite.] *Arbeitsgemeinschaft für Forschung des Landes Nordrhein-Westfalen, Wissenschaftliche Abhandlungen*, Vol. 1, issued Cologne (Westdeutscher Verlag), **1958.** 38 p. 21 figs., 4 tables, 5 refs., 29 eqs. **DLC** (QC802.B64P7). Review by S. F. Singer, *Physics Today*, 11(7), July **1958.**—Trajectory data and their time variations due to precession and to friction in the earth's atmosphere were calculated from measurements of Doppler effect and recordings of signal field strength at 20 and 40 MHz. The trajectory data are presented. For the precession of the trajectory, the authors obtained 2.96 ± 0.20 °/d in good agreement with the theoretical value of D. G. KING-HELE and D. M. C. GILMORE. For atmospheric limits at 215 km (over the mean globe [$R = 6371$ km] at 42°N lat.), a value of $4.7 \cdot 10^{-13}$ g cm^{-3} was obtained. This value is five times as large as the density obtained for that altitude from American rocket experiments in 1952/53. *Subject Headings:* **1. Radio observation techniques 2. Doppler effect 3. Upper atmosphere densities.**—*Transl. of authors' abstract* (*G.T.*).

11J–138 551.507.362.2:551.510.3

Priester, W., **Radiobeobachtungen des ersten künstlichen Erdsatelliten.** [Radio observations of the first artificial satellite.] *Die Sterne*, Leipzig, 34(3/4):64 69, **1958.** 4 figs. **DLC**—The 20,005 and 40,002 MHz signals of the first satellite have been observed and registered at many places; at the laboratory of the Bonn university, the impulses of the satellite were received on Oct. 5, 1957

at 05h22 U.T. and registered on Oct. 6, 1957 (figure gives the registered curves). The observations were developed to fix the satellite orbit and also to determine the variations of the orbits elements. Observations made: 1) recording of the 20,005 MHz field value; 2) recording of the 40,002 MHz field value; 3) measurement of Doppler effect. From the first registrations and using Soviet information giving a declivity of 65° for the orbit, a first approximation of the evolution of the orbit is calculated. A figure gives a diagram for the determination of the height of the satellite and another figure shows the decrease of air density with height. *Subject Headings:* **1. Soviet satellite, 1957 Alpha (Sputnik I) 2. Satellite orbits 3. Air density variations 4. Radio observations techniques**—*A.V.*

11J–139 551.507.362.2:551.510.536:551.510.3

Reed, Jack W. (*Sandia Corp.*), **A note on satellite density observations.** *American Meteorological Society, Bulletin*, 40(6):310–311, June **1959.** 2 figs., 5 refs. **DWB, DLC**—Calculations of atmospheric density at 250 mi height, based on Minitrack observations of Sputnik I, show density to be 40 times as high as previous estimates indicated. This is held to be an error, attributable in part to assumption of too low temperatures in the ozonosphere layer. The paper further illustrates this point by discussing the instances of acoustic observations reported at American Meteorological Society national meetings in 1954 and 1956. Atmospheric temperature and altitude models are graphically represented. *Subject Headings:* **1. Upper atmosphere density observations 2. Soviet satellite, 1957 Alpha (Sputnik I).**—*I.S.* Ⓢ

11J–140 551.507.362.2:551.510.53:551.510.3

Schilling, G. F. and Sterne, T. E., **Densities of the upper atmosphere derived from satellite observations.** *Smithsonian Institution. Astrophysical Observatory, IGY Project 30.10, Special Report*, No. 12:37–43, April 30, **1958.** fig., table, 11 refs. **DWB**—Oct. 1957 marked the launching of the first earth satellite. Since then studies of the orbital information have led to the evaluation of the upper atmosphere density at various altitudes. This report gives the numerical values, the results of early calculations, and the portions of model atmospheres between 175 km and 400 km (geometric). It is concluded that the density values furnished by the artificial satellites appear to fall between those furnished by sounding rockets and those by meteor observations. *Subject Headings:* **1. Upper atmosphere densities 2. Atmospheric models 3. Satellite data.**—*N.N.*

11J–141 551.510.3:551.524.7:551.510.53:551.507.362.2

†Schilling, G. F. and Sterne, T. E. (*Smithsonian Astrophysical and Harvard Col. Obs.*), **Densities and temperatures of the upper atmosphere inferred from satellite observations.** *Journal of Geophysical Research*, Wash., D. C., 64(1):1–4, **1959.** fig., 2 tables, 21 refs. **DLC**—Surface observations of artificial Earth satellites permit the inference of upper atmosphere densities from changes in the orbital elements caused by drag. The atmospheric density between some 180 km to 400 km alt. appears to be appreciably higher, on the average, than was usually thought before satellite data became available. In order to be consistent with the observed phenomena, the atmospheric temperature at or below these altitudes must also be higher than that given by a number of model atmospheres. *Subject Headings:* **1. Satellite density measurements 2. Upper atmosphere densities 3. Upper air temperatures.**—*Authors' abstract.* Ⓢ

11J–142 551.510.3:551.510.53:551.507.362.2

*Schilling, G. F. and Whitney, C. A. (*both, Smithsonian Astrophysical and Harvard College Obs., Mass.*), **Derivation and analysis of atmospheric density from observations of Satellite 1958 Epsilon.** *Planetary and Space Science*, N. Y., 1(2):136–145, April **1959.** 2 figs., 5 tables, 25 refs., eq. **DWB.** Also issued as **Atmospheric densities from Explorer IV.** *Smithsonian Institution, Astrophysical Observatory, Special Report* No. 18:13–22, Oct. 4, **1958.** fig., 5 tables, 18 refs. **DWB.** Reprinted in *IGY*, 1957/1958. *IGY World Data Center A, Rockets and Satellites, IGY Satellite Report Series*, No. 8:93–102, June 15, **1959.**—The orbital behavior of Satellite 1958 Epsilon has been analyzed to derive average upper atmosphere densities in the altitude interval of 257 km to 270 km between lat. 50°N and 50°S. The method of computation and possible errors in the calculations are discussed in detail. At an altitude of 262.5 km above intermediate northern latitudes, the most probable value of mean density was found to be $1.3 \pm 0.4 \times 10^{-13}$ g/cm³. All numerical results showed a high degree of internal consistency, but gave no evidence of any appreciable variation of average density between latitudes 49°N and S during the time interval July to November, 1958. The data did not warrant firm interpretation of small deviations which could be ascribed to either a day-night effect or slightly higher mean densities in the Northern Hemisphere. At about 50°N and S lat., however, a sharp discontinuity was found, with the average density value in the Northern Hemisphere about twice that in the Southern Hemisphere. Assuming this to be a real phenomenon, the authors present tentative conclusions about the physical and dynamical state of the upper atmosphere. In addition,

an explanation is offered for some of the apparent discrepancies between mean density values obtained from satellite observations and many of the measurements by means of high-altitude research rockets. *Subject Headings:* **1. Satellite air density measurement techniques 2. Upper atmosphere density data. 3. U. S. satellite, 1958 Epsilon (Explorer IV).**—*Authors' abstract.* Ⓢ

11J–143 551.510.535:551.507.362.2

Research based on Sputniks I and II reported by Soviets. *Science*, Wash., D. C., 127(3311): 1378–1381, June 13, **1958. DLC**—Excerpts from the article **Soviet artificial earth satellites** which the Soviet Embassy, Wash., D. C., released May 19, 1958. The popular article is based on results as published in Pravda, April 27, 1958. It is stated that scientific papers are to be published in various journals. The highlights may be summed up as follows: The density of the upper layers of the atmosphere at 225–228 km appears to be 5 to 10 times greater than theoretical values before sputniks. Changes of the state of the atmosphere as dependent on latitude and time of day are assessable. The temperature at 225 km altitude was higher than shown by pre-sputnik theories and higher than solar influence may yield. Determination of electron densities are predictable from known deflection of the radio beam. Cosmic ray particle number can be determined as dependent on altitude. The increase was about 40% from 225 km–700 km altitude. Variation of intensity which is believed to relate to the interplanetary environment near the earth may be checked by the now possible cosmic ray "sounding" of the earth's magnetic field at very great distances from the globe. Electrocardiograms obtained from the first dog in space revealed no morbid symptoms, the heart beat diminished frequently due to increase of the acceleration. The weightlessness in orbit was taken quite well, movements were brief and rather smooth. *Subject Headings:* **1. Upper atmosphere densities 2. Satellite research 3. Soviet satellites.**—*W.N.*

11J–144 551.507.362:629.19:061.3

Space program offered by Killian Advisory Committee. *Science*, Wash., D. C., 127(3302):803–805, April 11, **1958. DWB, DLC**—This is an excerpt from President Eisenhower's report of 26 March, 1958, on a program that was started for the intensive study of space technology. The report was prepared by his Science Advisory Committee. It covers many areas of interplanetary (earth-moon-Mars) adventures, communication and satellite network programs, as well as the detection of nuclear explosions. Meteorology is listed as one of the scientific and technical studies in this review. *Subject Headings:* **1. Space program 2. Satellites.**—*N.N.*

11J–145 523.1/2:629.19:061.3

Space Science Board (of National Academy of Sciences-National Research Council). *Science*, Wash., D. C., 128(3320):350–351, Aug. 15, **1958. DLC**—The 16-man Space Science Board as established by the National Academy of Sciences, National Research Council, has assumed the task "to survey in concert the scientific problems, opportunities and implications of man's advance into space" under the chairmanship of Lloyd V. Berkner. Activities and functions of the Space Science Board will be subject for coordinations and cooperation with similar domestic and foreign civil and government bodies. The eleven Ad Hoc committees organized are: (1) Geochemistry of space and exploration of moon and planets. (2) Astronomy and radio astronomy. (3) Future vehicular development. (4) International relations field. (5) Immediate problems. (6) Space projects. (7) Ionosphere. (8) Physics of fields and particles in space. (9) Future engineering development beyond available facilities. (10) Meteorological aspects of satellite and space research. (11) Psychological and biological research. The names of the chairmen of the different committees are listed. *Subject Headings:* **1. Space Science Board 2. Space flight research.**—*W.N.*

11J–146 551.507.362.2:061.1

World Meteorological Congress studies use of satellites. *Science*, Wash., D. C., 129(3360): 1412–1413, May 22, **1959. DLC**—On April 28, the World Meteorological Organization Third Congress completed a 4-week session in Geneva, after calling for a continuing review of the use of artificial satellites to obtain weather information, new studies on atomic energy questions and action to fill gaps in the world network of weather observation stations. The Congress, which meets once every 4 years, also planned its technical program and budget for the period 1960 through 1963. In the course of the session, WMO membership rose to 102 states and territories. *Subject Headings:* **1. Satellite uses 2. World Meteorological Organization.**—*I.S.* Ⓢ

11J–147 551.576.12:778.3:551.507.362.2

U. S. meteorological satellite cameras photograph cloud cover. *Science*, Wash., D. C., 131 (3406):1031–1032, April 8, **1960.** 2 figs. **DLC**—U. S. meteorological satellite Tiros I instrumentation for photographing cloud cover is described. *Subject Headings:* **1. Satellite instrumentation 2. Cloud photography 3. U. S. satellite, 1960 Beta (Tiros I).**—*E.Z.S.* Ⓢ

11J–148 551.507.362.2:521.312

Sedov, L. I., **Dinamicheskie effekty v dvizhenii iskusstvennykh sputnikov Zemli.** [Dynamic effects in the motion of artificial earth satellites.] *Iskusstvennye Sputniki Zemli*, Moscow, No. 2:3–9, **1958.** 4 figs., table, 9 refs., 3 eqs. **DLC.** Transl. into English in **Artificial Earth Satellites,** N. Y., Plenum Press, **1960.** Vol. 2:3–11. **DWB**—The theoretical computation of the orbit of an artificial earth satellite and its motion around the center of attraction involves an analysis of the factors acting upon the satellite as a result of the attraction of the earth, and interaction of the moving satellite with the atmosphere and the earth's electromagnetic field. The characteristics of the motion of the satellite as a heavy body relative to the center of gravity can be determined solely by Newton's law of gravity. The orbit of the satellite in the system of coordinates, moving relative to the stars and center of the earth is close to the osculating curve at each point of the revolution. The determination of the osculating ellipse with the focus in the center of the earth is illustrated. The effect of the resistance of the atmosphere on the rotation of the satellite is determined by the formula $W = C_x \rho \frac{Sv^2}{2}$ where W = force of resistance directed against the velocity of the center of gravity; ρ = density of the atmosphere; S = total area of outer surface; v = velocity of satellite and C_x = a coefficient depending upon atmospheric temperature, velocity of the satellite, geometrical form of the satellite and interaction of atmospheric molecules and atoms with particles constituting the satellite surface. An additional resistance is produced when a charged satellite moves in the plasma. The effect of W produces secular variations in the orbit; these consist of a decrease of eccentricity lowering of perigee for the osculating ellipse, since the period of rotation diminishes. If the difference of the heights of apogee and perigee is considerably greater than H then the basic effect of acceleration occurs in the small region of perigee where the atmospheric density is a maximum. The aerodynamic effects on rotation of the satellite are close to perigee. The aerodynamic forces produce a slightly perturbed motion. The interaction of the magnetic field of the earth with the metallic satellite produces in the latter a Foucault current and moments decelerating the rotation of the satellite near the center of mass. A table giving the values of the parameters of the first three artificial earth satellites of the U.S.S.R. and graphs showing the period of the revolution around the earth as a function of the number of revolutions, the variation of minimum height (perigee) and the variations of maximum height (apogee) are presented. A method of computing atmospheric density is presented together with the formula and results of calculations. *Subject Headings:* **1. Satellite orbits 2. Aerodynamic effects 3. Upper atmosphere density measurements 4. Soviet satellites.**—*I.L.D.*

11J–149 551.507.362.2

Shternfel'd, A. A., **Iskusstvennye sputniki Zemli.** [Artificial earth satellites.] Moscow, Gosud. Izdat. Tekhniko Teoreticheskoĭ Literatury, **1956.** 179 p. 27 figs., 10 tables. **DWB** (629.1388 S56lis)—A general account (75,000 copies) for popular consumption of the atmosphere, methods of studying it, laws of movement of artificial satellites, uses in observing and recording weather and astrophysical elements or events, problems of observation and transmission, trajectory and height of sputniks, techniques of firing and control, conditions on board a sputnik, communication with the earth, and legal aspects of space and space flight. The book was published "before sputnik" but contains imaginative illustrations of possible space travel vehicles. (*Same item as* 10.1–32, Jan. 1959, *Met. Abstr.*) *Subject Heading:* **1. Satellite observatories.**—*M.R.*

11J–150 551.507.362.2:551.510.3 551.507.362.2:551.547

Sicinski, H. S.; Spencer, N. W. and Boggess, R. L. (*all, Engineer. Res. Inst., Univ. of Michigan, Ann Arbor*), **Pressure and density measurements through partial pressures of atmospheric components at minimum satellite altitudes.** (In: Van Allen, James A., (*ed.*), **Scientific uses of earth satellites.** Ann Arbor, Univ. of Michigan Press, **1956.** p. 109–119, 5 figs., 12 refs., 14 eqs.) **DWB, DLC.** Also in: Michigan. Univ. Engineering Research Institute, Contract AF 19(604)-545, Report CS-5, March 1956.—Pressures in 400–900 km ranges are expected to be 10^{-10} to 10^{-8} mm, and densities 10^6 to 10^8 particles/cm^3. Ionization chambers would not be useful in this range but modified "omegatrons" or "synchrometers" would be sensitive at 10^{-10} mm pressure. Equipment operates like a cyclotron: the ions are accelerated by the alternating field. Article specifies environment, theory of operation of "synchrometer." Resolution, data output, satellite instrumentation, ionized and unionized environment and tuned gages are outlined. (*Same item as* 8.9–70, Sept. 1957, *Met. Abstr.*) *Subject Headings:* **1. Satellite pressure measurements 2. Satellite density measurements 3. Synchrometers.**—*M.R.*

11J–151 551.507.362.2

Sinclair, Archibald R. (*Langley Research Center, Langley Field, Va.*), **Reflection characteristics of artificial satellites constructed in the form of inflated polyhedrons,** *U. S. National Aeronautics*

and Space Administration, Technical Note, D-174, Dec. **1959.** 9 p. 4 figs., ref. **DWB**(629.1308 U585tnD)—Tests were made of inflated polyhedral shapes of thin aluminum-coated plastic to determine their suitability as artificial earth satellites having enhanced visibility as a result of bright flashes of reflected light from the facets. It was found that a polyhedron with 12 major faces, when inflated as a simple balloon, gave about one flash per revolution about a random axis when illuminated by a light representing the sun. As a result of the bulging of facets, the brightness of these flashes was only about three times that from an equivalent sphere, which is much less than the theoretical brightness from a polyhedron having optically flat facets. *Subject Heading:* **1. Satellite reflectivity.**—*Author's abstract.* ⑤

11J–152 551.510.53:551.507.362.2

Singer, S. Fred (*Univ. of Maryland Dept. of Phys.*), **Studies of a minimum orbital unmanned satellite of the earth (MOUSE). Pt. 1, Geophysical and astrophysical applications.** *Astronautica Acta,* Vienna, 1(4):171–184, **1955.** 3 figs., 11 refs. German and French summaries p. 171–172. **DWB—Pt. 2, Orbits and lifetime of minimum satellites.** N. Y., American Rocket Society, **1954.** 21 p. 16 figs., 3 refs., 43 eqs. Mimeo. (For Pt. 3, and 4, see 11J–55.) **DWB**—Pt. 1. Continuous observation of solar ultraviolet and X radiation, research into causes of magnetic storms and auroras, observation of cosmic rays and micrometeorites, measurements of the earth's albedo, study of the ionosphere, and investigations of density, wind, temperature and turbulence in the outermost atmosphere are discussed. A satellite with instruments weighing a total of 50 pounds is believed to be adequate for such measurements. Pt. 2. The purpose of this paper is twofold: (1) To describe the (elliptical) orbit of an artificial satellite in terms of launching conditions, (2) To investigate the subsequent behavior of the orbit under the influence of the drag of the upper atmosphere. The "lifetime" of the satellite depends on its area and mass, and is related to the upper atmosphere densities; hence these densities can be determined from measured changes of the orbit by methods discussed in detail. (*Same item as* 7.11–123, Nov. 1956, and 8.7–84, July 1957, *Met. Abstr.*) *Subject Headings:* **1. Project MOUSE 2. Satellite orbits 3. Upper atmosphere density measurement techniques.**—*Author's abstract and G.T.*

11J–153 551.507.362.2:629.19

†Singer, S. Fred, **Geophysical research with artificial earth satellites.** *Advances in Geophysics,* Ed. by H. E. Landsberg, 3:302–367, **1957.** 38 figs., 6 tables, 79 refs. **DWB, DLC**—Also issued as *Maryland. Univ. Physics Dept., Technical Report,* No. 53. 22p. 38 figs., 6 tables, 79 refs., eqs. Mimeog. (Note: figs. not included in the Mimeog. version.) **DWB**—Systematic coverage of the uses and advantages of artificial satellites in geophysical (geomagnetic, geodetic and meteorological) research. The 8 fields of study treated in 8 chapters of Pt. 2 cover: 1) Earth's interior, 2) Albedo, thunderstorms, clouds and infrared emissions from lower atmosphere or surface, 3) Chemosphere (ozone, airglow and aurora), 4) Ionosphere, 5) Exosphere, 6) UV and X rays, 7) Cosmic rays and 8) Meteors. Pt. 3 deals with applications to broad problems (energy balance and solar-terrestrial relations, and Pt. 4 with limitations of earth satellites of 3 types (inert satellite, satellite with telemetering and satellite with altitude control). Advantages of earth satellites are discussed in introduction (location, coverage, cost and uniqueness). Good bibliography. (*Same item as* 8.7–119, July 1957, *Met. Abstr.*) *Subject Headings:* **1. Satellite observatories 2. Albedo measurement with satellite 3. Solar-terrestrial relationships.**—*M.R.*

11J–154 551.507.362.2:551.501.89

Singer, S. Fred, **Minimum earth satellites as "storm patrol."** *Scientific Monthly,* Wash., D. C., 85(2):95–98, Aug. **1957.** 5 figs., 4 refs. **DWB, DLC**—The author, in his discussion of the minimum earth satellites as "storm patrol," has laid great emphasis on the role of meteorology and its application, since the weather of the earth affects all the phases of human existence. Satellites possess the singular ability of observing weather conditions in even the most inaccessible areas of the globe. This report contains an evaluation of the application of a minimum satellite (altitude 200–300 mi) to the problem of recognizing meteorological features in order to observe their time variation in position and intensity. (*Same item as* 11.2–82, Feb. 1960, *Met. Abstr.*) *Subject Headings:* **1. Satellite uses 2. Storm detection.**—*N.N.*

11J–155 551.507.362.2:629.19

*Singer, S. F., **Meteorological measurements from a minimum satellite vehicle.** *American Geophysical Union, Transactions,* 38(4):469–492, Aug. **1957.** 18 figs., 2 tables, 26 refs. **DWB, DLC**—A satellite lends itself ideally to the world wide measurement (1) of the Earth's visible albedo (that is, scattered and reflected sun light), (2) of the infrared emission from the Earth and its atmosphere, and (3) of the altitude distribution of ozone. The present paper specifically does not discuss measurements of solar and other extraterrestrial radiations although it is realized that ul-

timately they may be of major importance. The satellite problems are first discussed: A polar orbit is to be preferred. It is necessary for the satellite to be at least partly oriented; for certain orbits a simple spin orientation is sufficient. The detector problems for the ozone, infrared, and visible are treated in detail. At the present state of the art considerations of weight, and also storage and telemetering problems speak against the use of television. It is demonstrated, however, that the resolution attainable with a minimum satellite and simple detectors is adequate for the following applications: (1) a more accurate determination of the global heat balance and the general tropospheric circulation patterns; (2) long-term albedo changes and their relation to climatic changes; (3) synoptic albedo measurements and the tracking of the development and motion of storm centers; (4) gathering of information which can be correlated with the generation of waves superimposed on the general atmospheric circulation, leading therefore to improved long range weather predictions; (5) determination of variations of the vertical ozone distribution, and resulting applications to stratospheric wind systems, upper troposphere advection and vertical transport phenomena. (*Same item as* 9.2 96, Feb. 1958, *Met. Abstr.*) *Subject Headings:* **1. Satellite observatories 2. Satellite instrumentation 3. Satellite orbits.**—*Author's abstract.*

11J–156 551.507.362.2:551.508

Singer, S. F., **Satellite instrumentation: results for the IGY.** *Franklin Institute, Phil., Journal . . . Monograph*, No. 6:51–70, Dec. **1958.** 12 figs., 3 refs. **DWB** (629.1388 F832te)—The discussion deals with (1) knowledge gained by the behavior of uninstrumented satellites, (2) measurements of various kinds obtainable by satellite-borne instruments and (3) a comparison between the Russian and U. S. instrumentation of satellites. Author's suggestion of a gyroscopic principle for a detector pointed at the sun or at the earth by means of a spin axis seems feasible. Likewise the use of solar batteries for storage of information gathered on tapes as a part of the telemetering system which transmits to an earth receiver whenever a radar beacon hits the receiver. The meteorological gain, particularly as derived from albedo measurements of the earth is inestimable. WEXLER's (U. S. Weather Bureau) concept (depicted here) of the North American continent as seen from 4000 mi altitude is quite illustrative in this respect. The electrical charge (if any) of a satellite and how it changes is a problem for which instrumentation is considered. *Subject Headings:* **1. Satellite instrumentation 2. Satellite albedo measurements 3. IGY satellite program.**—*W.N.*

11J–157 551.507.362.2:551.510.536:546.21:537.563

Singer, S. F., **Structure of the earth's exosphere.** *Journal of Geophysical Research*, 65(9):2577–2580, Sept. **1960.** fig., 11 refs., 6 eqs. **DLC.** Also issued as: Maryland. Univ. Dept. of Physics, Contract AF 19(604)-3861, [Unnumbered Report]. **1960.** 8 p. fig., 10 refs.—The main components of the earth's exosphere are neutral oxygen, neutral hydrogen atoms, ionized oxygen, and ionized hydrogen. The position of the base of the exosphere is established at an altitude of 530 km from an analysis of density data obtained from satellite drag observations. The relative distribution of both neutral oxygen and neutral hydrogen is derived from a theory of the exosphere. The normalization of hydrogen is accomplished by the use of the Lyman-alpha technique of Johnson, Friedman and Tousey. The distribution of ionized oxygen can be established jointly from the rocket measurements of Berning and from an analysis of radiation belt data obtained from satellites. They give a consistent picture of ionized oxygen becoming the most important constituent of the atmosphere at about 1500 km. The distribution of ionized hydrogen is only imperfectly known at the present time. *Subject Headings:* **1. Exosphere 2. Upper atmosphere density measurements 3. Satellite data. I. Maryland. Univ. Dept. of Physics II. Contract AF 19(604)-3861.**—*Author's abstract.* Ⓢ

11J–158 551.510.534:546.214:551.507.362.2

Singer, S. Fred and Wentworth, R. E. (*both, Dept. of Physics, Univ. of Md., College Park*), **A method for the determination of the vertical ozone distribution from a satellite.** *Journal of Geophysical Research*, Washington, D. C., 62(2):299–308, June **1957.** 6 figs., 4 tables, 14 refs., 11 eqs. **DLC**—Because of its long lifetime below 45 km, ozone can deviate markedly from the concentration given by the photochemical equilibrium considerations. Hence, the ozone concentration can be used as an indicator of the motion of air masses, particularly in the stratosphere. The meteorological implications can be fully realized only by the synoptic measurements, for which an artificial earth satellite is ideally suited. The method described employs the optical absorption properties of ozone in the ultraviolet region around 2900A. A detector looking down towards the earth will receive solar ultraviolet scattered by the atmosphere which has been attenuated both by scattering out and by ozone absorption. Calculations are presented to illustrate the effective depth in the atmosphere to which the detector "sees," the effective depth being defined as the point above which 90% of the contribution to the detector response is made. The sensitivity of the method to changes in the ozone concentration at various altitudes is also demonstrated. (*Same item as* 10F–167,

June 1959, *Met. Abstr.*) *Subject Headings:* **1. Vertical ozone distribution 2. Satellite ozone observation.**—*Authors' abstract.*

11J–159 551.507.362.2:551.510.3:551.510.536

Siry, Joseph W. (*U. S. Naval Res. Lab. now, Goddard Space Flight Center, Wash. D. C.*), **Satellites orbits and atmospheric densities at altitudes up to 750 km obtained from the Vanguard Orbit Determination Program.** *Planetary and Space Science*, N. Y., 1(3):184–192, Aug. **1959.** 10 figs., 3 tables, 8 refs. **DWB.** Also in: *International Astronomical Union, Transactions*, 10:720–722, **1958.** 2 figs., 3 refs., **DLC**—The data collected and analyzed by the Vanguard Orbit Determination Program is discussed, tabulated, and graphically represented. It pertains mainly to the determination of the orbits of artificial earth satellites and to the air density at a very high altitude. The orbit determination system of Vanguard I and Explorer III are reported. It is noted that the best estimate of the overall performance of the entire orbit determination system, including the minitrack observing system and the orbit computing system is obtained by analysis of the orbit of the Vanguard satellite, 1958 β_2. It is further reported that a significant measure of air density at a very high altitude was obtained from the orbital data for the satellite 1958 β_2, Vanguard I. Mathematical approach is adopted to analyze the pycnometric level for the Vanguard satellite. It is suggested at the same time that an analysis of the Vanguard satellite orbital data can also be made by means of an approach in which an appeal to the physical theory is made. *Subject Headings:* **1. Satellite orbits 2. U. S. satellite, 1958 Beta (Vanguard I) 3. U. S. satellite, 1958 Gamma (Explorer III) 4. Upper atmosphere density measurements.**—*I.S.* Ⓢ

11J–160 551.507.362:551.510.3

Spitzer, Lyman, Jr. (*Princeton Univ. Obs.*), **On the determination of air density from a satellite.** (In: Van Allen, James A. (*ed.*), **Scientific uses of earth satellites.** Ann Arbor, Univ. of Mich. Press, **1956.** 99–108. 8 refs., 10 eqs.) **DWB, DLC**—Methods are analyzed for determining upper-air densities by means of a satellite, either by measures of the orbit or by measures of the change in orientation of a suitably designed vehicle. The orbital method gives enormous accuracy for the air density at perigee altitude, but fluctuations of perigee density with time may prevent accurate density determinations at heights much above the perigee altitude. If a satellite is designed so that its center of pressure is far from its center of mass, measures of the change in orientation with time can, in principle, determine air densities much less than the probable density of 4×10^{-15} gm/cm³ at 300-km height. For a spinning satellite of about the weight and size planned for the IGY, a measurement of the precession rate by means of photocells observing the sun and the earth would permit measuring air densities as low as 10^{-16} gm/cm³, after eddy currents produced by the earth's magnetic field increased the spin period to about 100 sec. (*Same item as* 9.3–85, March 1958, *Met. Abstr.*) *Subject Headings:* **1. Satellite density measurements 2. Upper atmosphere densities.**—*Author's abstract.*

11J–161 551.507.362.2:551.510.3:551.510.536

Sterne, Theodore E. (*Smithsonian Astrophysical and Harvard College Observatories*), **An atmospheric model, and some remarks on the inference of density from the orbit of a close earth satellite.** *Astronomical Journal*, New Haven, Conn., 63(3):81–87, March **1958.** 4 tables, 4 refs., 12 eqs. **DLC**—The U. S. Air Force has extended the U. S. Standard Atmosphere to over 540,000 m of altitude. The author has extended the Air Force model to still greater heights, and suggests the employment of the resulting model for inferring the air density from observations of the orbit of a close earth satellite. Convenient equations, involving easy numerical quadratures in the eccentric anomaly, are derived accurately and fundamentally for the time-derivatives of the perigee and apogee distances of a close earth satellite moving through an atmosphere. If the extended Air Force atmospheric model is nearly correct, then a 50-centimeter, 10-kilogram, spherical earth satellite with a perigee height of about 200 mi and an apogee height of about 800 mi should be expected to have a life-time of about nine years. Calculations of only slide-rule accuracy enable rather accurate adjustments to be made to the density near perigee, from observations of the changing apogee distance. The density may not be determined from astronomical observations with much relative accuracy at heights much above the initial perigee. It is suggested that definitive adjustment of the atmospheric density be made by a least-squares solution in which the unknowns are the vertical gradients of the ratio of temperature to molecular weight in selected altitude zones. Equations are given for the differential changes in air density caused by differential changes in such gradients. (*Same item as* 10.10–157, Oct. 1959, *Met. Abstr.*) *Subject Headings:* **1. Standard atmosphere 2. Satellite density measurements 3. Upper atmosphere densities.**—*Author's abstract.*

11J–162 551.507.362.2:551.510.53:551.510.3

Sterne, Theodore E. (*Smithsonian Institution Astrophysical Obs. and Harvard College Obs.*), **Formula for inferring atmospheric density from the motion of artificial earth satellites.** *Science*,

Wash., D. C., 127(3308):1245, May 23, **1958.** 3 refs., 3 eqs. **DLC**—A simple formula, $K = 2.3026 (d/dz) \log 10\rho$, is proposed for finding the interfering air density from satellite motion at perigee; where ρ is the density approximated near perigee by $\rho_\pi e^{-kz}$; ρ_π, the density at perigee; Z, altitude above perigee and K, logarithmic gradient of density at perigee. The development of this formula and the solutions are demonstrated. *Subject Headings:* **1. Satellite orbits 2. Upper atmosphere density measurements.**—*N.N.*

11J–163 551.507.362.2:551.510.53:551.510.3

Sterne, Theodore E. (*Harvard College Obs., Camb., Mass.*), **Density of the upper atmosphere.** *Science*, Wash., D. C., 128(3321):420, Aug. 22, **1958.** 8 refs. **DLC**—Brief contribution on the difference of density values are obtained theoretically by the ARDC model atmosphere vs. the observation by U. S. Explorer I which was 1.5×10^{-14} g/cm³ at 368 km or 14 times the model value, and the observation by the U.S.S.R. Alpha 2 which was 4.5×10^{-13} g/cm³ at 220 km or 9 times the model value. From observations of both satellites together the inferred density values of about 1.4×10^{-14} g/cm³ at 368 km and 4.0×10^{-13} at 220 km do not agree so well with HARRIS' AND JASTROV'S results as they tend to align with the curve by STERNE and SCHILLING. *Subject Headings:* **1. Atmospheric models 2. Upper atmosphere density data 3. U. S. satellite, 1958 Alpha (Explorer I) 4. Soviet satellite, 1957 Alpha (Sputnik I)**—*W.N.*

11J–164 551.510.53:551.510.3:551.507.362.2

Sterne, T. E., Folkart, B. M. and Schilling, G. F. (*all, Astrophysical Obs., Smithsonian Inst.*), **An interim model atmosphere fitted to preliminary densities inferred from U.S.S.R. satellites.** *Smithsonian Institution. Astrophysical Observatory, IGY Project No. 30.10, Special Report*, No. 7, Dec. 31, **1957.** 8 p. 3 figs., 7 refs., 8 eqs. **DWB.** Also issued in "edited form" as *Smithsonian Contributions to Astrophysics*, Wash., D. C., 2(10):275-279, **1958. DWB, DLC**—As earlier reported, preliminary values of the atmospheric density have been inferred from observations of artificial U.S.S.R. earth satellites. Those densities were greater than the densities predicted by most existing atmospheric models at corresponding altitudes. The present paper presents an interim and highly tentative atmospheric model adjusted to be the same as the ARDC model atmosphere, devised by MINZNER and RIPLEY, at altitudes below about 90 km, and to agree with the densities inferred from the satellites at an altitude of 220 km (4.5×10^{-10} kg/M³ or 8.7 times the density predicted by MINZNER and RIPLEY.) Although this model is crude and only roughly approximate, it may be of use in predicting the life-times of new earth satellites. (*Same item as* 9.11-159, Nov. 1958, *Met. Abstr.*) *Subject Headings:* **1. Atmospheric models 2. Air density calculations 3. Satellite observations.**—*Authors' abstract.*

11J–165 551.510.3:551.507.362.2

Sterne, T. E. and Schilling, G. F. (*both, Astrophysical Obs.*), **Some preliminary values of upper atmosphere density from observations of U.S.S.R. satellites.** *Smithsonian Institution. Astrophysical Observatory, IGY Project No. 30.10, Special Report*, No. 3, Nov. 15, **1957.** 10 p. 14 refs. **DWB** (629.1388 S661so). Also issued in "edited form" as *Smithsonian Contributions to Astrophysics*, Wash., D. C., 2(10):207-210, **1958. DWB, DLC**—On the basis of available orbital data for the U.S.S.R. Satellites 1957 Alpha One, Alpha Two, and Beta One, preliminary values of atmospheric density have been calculated for the respective perigee altitudes. The computations necessarily involve a number of speculative assumptions with regard to mass-area ratios, but the results show a reasonable consistency in numerical values derived from the three satellites independently. It would appear that the atmospheric density at altitudes between 220 km and 230 km is somewhat higher than has often been assumed. While the values derived here must be considered as being of an extremely tentative nature, it is expected that similar methods of calculation will, in the future, permit the inference of atmospheric density over a wide range of altitudes from orbital data. (*Same item as* 9.11-84, Nov. 1958, *Met. Abstr.*) *Subject Headings:* **1. Satellite observations 2. Air density calculations.**—*Authors' abstract.*

11J–166 551.507.362.2:551.576.1:621.397.5

Sternberg, Sidney (*RCA Astro-Electronic Products, Div., Princeton, N. J.*) and Stroud, William G., (*NASA Goddard Space Flight Center, Beltsville, Md.*), **Tiros I: meteorological satellite.** *Astronautics*, N. Y., 5(6):32-34, 84-86, June **1960.** Figs., photos. **DLC**—The first two weeks operation of Tiros I proved the feasibility of using television-camera equipped satellites for viewing the earth cloud cover and returning pictures of large clouded areas back to earth. Some of the representative cloud pictures, the launching of the weather satellite, a cutaway view of major components and the relative camera coverage areas are shown. The Tiros I exceeded expectations and its success predicts a brilliant future for such observation satellites and world-wide meteorology. *Subject Headings:* **1. Weather satellites 2. U. S. satellite, 1960 Beta (Tiros I) 3. Cloud photography.**—*E.K.* ⓢ

11J–167 551.507.362.2

Stroud, W. G. (*Natl. Aeronautics and Space Admin., Wash., D. C.*), **Initial results of the TIROS I meteorological satellite.** *Journal of Geophysical Research*, Wash., D. C., 65(5):1643–1644, May **1960.** 2 figs., 2 tables. **DLC**—Characteristics of the satellite operation and cameras are summarized. Photographs taken by wide-angle and by narrow-angle cameras show promise in the use of the satellite as a meteorological research tool. *Subject Headings:* **1. Weather satellites 2. U. S. satellite, 1960 Beta (Tiros I) 3. Satellite photography.**—*E.S.* Ⓢ

11J–168 551.521.14:551.507.362.2

Stroud, W. G. and Nordberg, W. (*Signal Corps Eng. Labs., Ft. Monmouth, N. J.*), **Meteorological measurements from a satellite vehicle.** (In: Van Allen, James A. (*ed.*), **Scientific uses of earth satellites.** Ann Arbor, Univ. of Michigan Press, **1956.** p. 119–132. 9 figs., 3 tables, 12 refs.) **DWB**—Among the meteorological observations which could be made from an earth satellite are albedo measurements with a photodetector. The satellite must be capable of giving orientation information. The theory variations with latitude, time of day and season, and for various types of surfaces (snow, rock, vegetation, sea, clouds), for various wave lengths, cloud thickness, etc., methods and instruments, orientation and telemetering problems and operational requirements are discussed and illustrated with graphs, charts and diagrams. (*Same item as* 8G–212, July 1957, *Met. Abstr.*) *Subject Headings:* **1. Satellite albedo measurement 2. Albedo data.**—*M.R.*

11J–169 550.3:551.505.22(437)

Programma rabot v mezhdunarodnom geofizicheskom godu v Chekhoslovakii. [Program of the International Geophysical Year in Czechoslovakia.] *Studia Geophysica et Geodaetica*, Prague, 1(2):396–403, **1957.** In Russian and English. **DWB**—The Czechoslovak Academy of Sciences called a working conference in April 1957 where they discussed the warning and communications centers that should be in operation during the World Days. Areas of interest to be undertaken and studied during the IGY were: meteorology, geomagnetism, aurora and airglow, ionosphere, solar activity, cosmic radiation, geographical latitudes and longitudes, rockets and satellites, seismology, gravimetry, and nuclear radiation. *Subject Headings:* **1. IGY program 2. Czechoslovak participation in IGY.**—*N.N.*

11J–170 551.507.362:629.19

Thiruvenkatachar, V. R. (*Inst. of Armament Studies, Kirkee*), **An artificial satellite for the earth.** *Journal of Scientific and Industrial Research, Sec. A*, New Delhi, 15(2):61–63, Feb. **1956.** 6 refs. **DWB, DLC**—Nature, orbit, launching and scientific uses (astronomy, geodesy, meteorology, etc.) of an earth satellite such as is being developed for use during IGY is described at some length. (*Same item as* 8.10-53, Oct. 1957, *Met. Abstr.*) *Subject Heading:* **1. Satellite observatories.**—*M.R.*

11J–171 551.507.362:629.19 551.510.53:061.3

Townsend, J. W., Jr. (*N. A. & S. A., Wash., D. C.*), **Experimental research program in the space sciences.** *Journal of Geophysical Research*, Wash., D. C., 64(11):1779–1787, Nov. **1959.** 5 figs., 5 tables. **DLC**—This is a well illustrated article of the satellite and space probe research that is under consideration by the National Aeronautics and Space Administration. This effort had led to five new payload designs: 1) atmospheric structure satellite—to measure the distribution of pressure, temperature and density; 2) space probe—with emphasis on detection of particles in space; 3) ionosphere satellite—to provide direct data for ionospheric measurement; 4) orbiting astronomical observatory—its primary instrument is the x-ray spectrograph for solar radiation; 5) magnetometer space probe—designed for magnetic field measurements from the earth to the vicinity of the moon and beyond. *Subject Headings:* **1. Research programs 2. Space flights 3. NASA.**—*E.K.* Ⓢ

11J–172 551.506.7:551.507.362.2:612

Einige Ergebnisse der ersten beiden russischen Erdsatelliten. [Some results of the first two Russian earth satellites.] *Die Umschau*, 58(11):341, June **1958. DWB, DLC**—A summary of a report published in *Pravda*, Moscow, No. 37, May 7, **1958**) on the results of the observations obtained by Sputnik I and II. The data from both satellites revealed that the temperature of the atmosphere at 225 km is greater than assumed hitherto on theoretical grounds. From the deviation of the radio beam of 40 MHz of the satellite transmitter in the ionosphere it is concluded that the diminution of electron concentration in the outer parts of the ionosphere is 5 to 6 times slower than the increase up to 300–400 km. The intensity of cosmic radiation increased by 40% between 225 and 700 km. The cosmic radiation is subject to considerable oscillations which are not observable at the surface of the earth. Furthermore "Laika" withstood the starting acceleration, which exceeded gravity several fold, without any untoward effects. The electrocardiogram showed no pathological symptoms; it showed a picture of sinus tachycardia. The initial increase in the heart rate increased and then diminished. After the satellite was in its course the respiration rate was 2–3 times that at the

beginning of ascent, it decreased during weightlessness. The changes in the physiological functions corresponded essentially with those observed in rocket investigations. *Subject Headings:* **1. Satellite observations 2. High altitude temperatures 3. Physiological effects on satellite passengers 4. Soviet satellites.**—*I.L.D.*

11J–173 551.506.7:551.510.53:551.507.362

U. S. Air Weather Service. Climatic Center, **Survey of availability of atmospheric data above 100,000 feet from U. S. rocketsonde and satellite observations.** Washington, D. C., Aug. 1959. [35]p. Mimeo.—Answers to questionnaires sent to 24 civilian and military agencies in the U. S. regarding, availability and type of upper atmosphere data from rockets and satellites up to mid 1959 are tabulated in great detail. Tabulations include replies to 30 questionnaires. Several more were excluded for security or other reasons (several agencies had more than one questionnaire or operation). The elements considered were wind, direction and speed; air density, temperature, pressure, turbulence, ion density, meteorite impacts; nightglow, ozone, magnetic, auroral, cloud, radiation, electrical and other measurements. (*Same item as* 11.5–167, May 1960, *Met. Abstr.*) *Subject Heading:* **1. Rocket and satellite data availability.**—*M.R.*

11J–174 551.507.362.1:016 551.507.362.2:016

†U. S. Dept. of the Army. Army Library, **Guided missiles, rockets and artificial satellites (including Project Vanguard): a selected list of titles.** Its *Special Bibliography*, No. 11, Jan. 23, **1957.** 153 p. "Current companion volume to its *Special Bibliography*, No. 4 (Guided Missiles). April 20, 1956." **DWB**—Briefly annotated or unannotated reference material is arranged in alphabetical order by title within major and sub subject groups, under Sec. VI, Missiles and Rockets (by type). Pt. E (Experimental and Specialized Vehicles) contains references to Aerobee rockets (p. 48), ASP (Atmospheric Sounding Projectile) (p. 48), Viking (p. 52). Artificial Satellites are covered in Pt. II (IGY program, p. 130; Project Vanguard, p. 131; other satellite projects, p. 145). Scientific applications of satellites are covered on p. 151. At least 50 papers or books of interest to meteorologists will be found in this section. No author or subject index is provided. (*Same item as* 8.8–81, Aug. 1957, *Met. Abstr.*) *Subject Headings:* **1. Satellite bibliographies 2. Rocket bibliographies.**—*M.R.*

11J–175 551.510.53:061.3

U. S. National Aeronautics and Space Administration, **The NASA space sciences program.** Wash., D. C., April 16, **1959.** 29 p. **DWB** (629.1388 U584na)—The paper is the description of the national space science program. In the conduct of satellite and space probe experiments, broad participation of the scientific community and industry, along with government is emphasized. The program includes several areas: atmospheres, ionospheres, energetic particles, electric and magnetic fields, gravitational fields, astronomy and biosciences. Each section covers: the principal scientific objectives, a review of present knowledge and the existing problems. It is pointed out that the national space science program is subject to modification as work progresses and scientific data and results are obtained from currently orbiting space vehicles. *Subject Headings:* **1. NASA space science program 2. Upper atmosphere research.**—*E.K.* Ⓢ

11J–176 551.515.3/4

†U. S. Weather Bureau, **Causes and characteristics of thunderstorms and other atmospheric disturbances.** 10th Interim Report, submitted in accordance with public law 657, 8th Congress. Wash., D. C., July **1958.** 57 p. 25 figs., table, 39 foot-refs., 36+21 refs. **DWB** (M15.4 U587ia)—The report is divided into three major sections with primary emphasis being placed on studies of hurricanes and tornadoes. The first section reviews the progress and future plans of the National Hurricane Research Project. The second section reviews the severe local storm problem, outlining the progress made during the past year and the need for expansion of this important phase of meteorological research. Included in this section is a review of the experimental use of Doppler radar to detect tornadoes. The third section outlines briefly the progress being made in other phases of meteorological research, including the use of earth satellites for meteorological purposes. (For earlier reports, *see* 3.5–151, May 1952, 4.4–119, April 1953, 6.11–205, Nov. 1955 and 10B–113 [Feb., 1959], *Met. Abstrs.*) (*Same item as* 10B–174, Feb. 1959, *Met. Abstr.*) *Subject Headings:* **1. Hurricane research projects 2. Tornado research projects 3. Satellite uses.**—*From authors' introduction.*

11J–177 551.510.53

U. S. White Sands Signal Corps Agency, New Mexico, **The missile geophysics program of the White Sands Signal Corps Agency.** Jan. **9, 1957.** 20 p. 25 figs. (incl. photos), bibliog. p. 19–20.—The field of work of the Missile Geophysics Program lies in the determination and application

of atmospheric physical techniques to the White Sands missile program. It involves a study of the interaction between the atmosphere and the various missile parameters. Measurements are carried out on surface winds, and on low level wind. Round the clock observations are carried out on the critical penetration frequencies and heights of the various ionospheric layers. Studies include atmospheric transmission on infrared, meteorological acoustics and the upper air. Photographs of various types of apparatus used are presented. *Subject Headings:* **1. U. S. White Sands Signal Corps Agency 2. Missile Geophysics Program 3. Upper atmosphere research.**—*I.L.D.*

11J–178 551.576.11:778.3

Vachon, D. N. and King, J., **High altitude cloud photography from ballistic missiles.** Phil. Penn., Missile and Space Vehicle Dept., General Electric Co., (1960?) 6 p. 2 figs. Photostat of typescript. **DWB** (M76 VII9hi)—During the time between separation and re-entry, the nose cones of IRBM's and ICBM's can be utilized for many scientific purposes. Recently, during the normal course of flight testing, 16 mm films were used to record the separation and stabilization processes. Although the camera system was not designed for cloud photography, we were able to obtain some extremely useful information. A brief analysis of the cloud systems has been made and is summarized with the use of a limited number of prints. The potential of future cloud photography during flight tests is explored. Conclusions: Cloud photography from IRBM's and ICBM's will aid the evaluation of what can be expected from weather satellites. Experience will be gained through various studies such as correlation with weather maps, orientation of "cloud streets," appearance of cloud systems, and so on. These studies and others like them will be of great value in enabling us to better evaluate our present and future programs. The usefulness of these films in research is evident. These films will provide a new dimension whereby certain theories can be developed, evaluated or refined. *Subject Headings:* **1. Clouds photography 2. Satellite uses.**—*Authors' abstract.* Ⓢ

11J–179 551.507.362.2(08)

†Van Allen, James Alfred (*ed.*), **Scientific uses of earth satellites.** Ann Arbor, Univ. of Michigan Press, **1956.** 316 p. figs., tables, bibliogs. throughout. Price:$10.00. **DLC**(QC807.5.V3), **DWB**—A compilation of 33 of the papers presented at the Upper Atmosphere Rocket Research Panel meeting at Ann Arbor, Mich. on Jan. 26–27, 1956. The papers are devoted to detailed, specific proposals for use of satellites in measuring temperature, density, air-drag, pressure, radiative heat transfer, visibility, hydrogen in space; UV, auroral and cosmic ray flux; geomagnetic field, ionospheric structure, meteoric drag, interplanetary dust, radio propagation, etc., as well as the performance of the satellite itself. (The papers are listed in Pt. III, p. 557, April 1957, *Met. Abstr.*, and have been abstracted separately.) (*Same item as* 8.4–6, April 1957, *Met. Abstr.*) *Subject Headings:* **1. Satellite observatory conferences 2. Satellite uses.**—*M.R.*

11J–180 551.507.362.2

Van Allen, James Alfred (*State Univ. of Iowa*), **The scientific value of the earth satellite program.** *Institute of Radio Engineers*, N. Y., *Proceedings*, 44(6):764–767, June **1956. DLC**—Planning for the fullest possible scientific utilization of the initial group of U. S. satellites is proceeding actively under the supervision of the National Academy of Sciences and its appropriate Panels and Working Groups. An inert satellite, tracked from an array of ground stations, will provide a means of unprecedented precision for the determination of the geodetic figure of the earth, for the transoceanic linkage of mapping networks, and for the measurement of atmospheric density at very high altitudes. A variety of physical observations with active, on-board instrumentation has been considered. The highest "flight-priority" has been assigned to the following: a) the monitoring of the intensity of the solar ultraviolet; b) the monitoring of cosmic ray intensity and the measurement of its latitude, longitude, and altitude dependence; c) the measurement of the size spectrum and the number density of interplanetary dust; and d) the measurement of the earth's optical albedo over large areas. A concerted attack on the technical problems of successful on-board observations is being made. (*Same item as* 8.3–110, March 1957, *Met. Abstr.*) *Subject Heading:* **1. Satellite observatory program.**—*Author's abstract.*

11J–181 551.508:551.507.362.2

Van Allen, James A., **Scientific instrumentation of satellites.** *American Geophysical Union, Geophysical Monographs*, No. 2:142–146, **1958. DLC**—The method employed by the Working Group on Internal Instrumentation (established by the U.S.N.C. Technical Panel on the Earth Satellite Program) to select satellite experiments with "on board" observing equipment is described. The solar ultraviolet intensity experiment involves the use of only a selective wave length ionization chamber covering the range of about 1100 to 1400 A; it is especially useful in monitoring the intensity of the Lyman Alpha line. The experiment involved the monitoring, measurement and observations of cosmic-ray intensity above the atmosphere over as large a geographical area as possible, made use

of a single Geiger table counter whose counting rate is electronically stored and read out on passage over the meridian fence of radio tracking stations. The experiment comprising extensive measurements of the earth's magnetic field at high altitudes and over an extended geographical area uses a proton precessional magnetometer and a 30-in. inflatable sphere, which will provide a sensitive and rapid method of determining the density of the earth's atmosphere at altitudes above those of previous experiments. The meteorological experiment measures the heat balance over the tropical belt of the earth and involves (1) mounting of four special temperature-sensing elements in symmetrical points on rods extended from the satellite and (2) the use of two photoelectric telescopes, whose lines of sight sweep across the earth and its lower atmosphere, for gathering synoptic data on the cloud cover of the earth within the latitude belt covered by the satellite. Other on-board experiments comprise the detection of extreme ultraviolet solar radiation, determination of electron density at the satellite altitude, measurement of accumulated meteoric erosion and various cosmic-ray measurements. *Subject Headings:* **1. Satellite instrumentation 2. Satellite research.**—*I.L.D.*

11J–182 551.507.362.2:621.396.8:551.510.535

Vassy, E., **L'émission radioélectrique des Satellites artificiels, Applications à la connaissance de l'ionosphère.** [Radio transmission from artificial satellites. Applications on the knowledge of the ionosphere.] *L'Onde Electrique*, Paris, 39(388/389):647–653, July/Aug. **1959.** 8 figs., table. French and English summaries. **DLC**—The radio features of the Soviet and U. S. artificial satellites are summarized. A description is then given of investigations of the properties of the upper atmosphere based on the simple reception of a transmitted radio signal without knowledge of the code. A report is made of the methods to determine the air density of the upper atmosphere, using the Doppler-Fizeau effect, radio interferometry, the Faraday effect and refractive waves. The author comments on these various methods and shows their great utility. (*Same item as* 11.5–166, May 1960, *Met. Abstr.*) *Subject Headings:* **1. Upper atmosphere density measurement techniques 2. Radio transmissions 3. Doppler-Fizeau effects 4. Faraday effects 5. Radio interferometer techniques.**—*A.V. and author's abstract.*

11J–183 551.507.362.2

Veldkamp, J., **De eerste Amerikaanse kunstmaan.** [The first American artificial satellite.] *Hemel en Dampkring*, The Hague, 56(7/8):147–149, July/Aug. **1958.** 3 figs. **DWB, DLC**—Description of the first U. S. satellite 1958α, sent up on 31-1-1958 at Cape Canaveral. Statement of the transmitters and observation methods, followed by a commentary of the research by means of satellites. *Subject Headings:* **1. Satellite observatories 2. U. S. satellite, 1958 Alpha (Explorer I)**—*A.V.*

11J–184 551.507.362.2:629.19

Vickney, Nicolas, **Les récents engins spatiauxa méricains.** [Recent American space vehicles.] *La Nature*, Paris, No. 3288:179–180, April **1959. DLC**—Statement on the launching of satellites Vanguard II, Discoverer I and Pioneer IV; program of scientific research carried out by means of these vehicles and anticipation of the results. *Subject Heading:* **1. U. S. satellites.**—*A.V.* Ⓢ

11J–185 551.507.362:629.19:551.510.53

†Vitro Laboratories, Silver Spring, Maryland, **The strato-lab as a research vehicle.** Contract NONR-2656(00), Technical Report No. 117, April 24, **1959.** (5 pts. separately paged) fig., table, 47 refs.—The exploration of astronomic and atmospheric phenomena has necessitated the creation of a stratospheric laboratory to study the rapid developments of future instrumentation, satellite and space vehicles. This report indicates the suggested experiments. These include studies in atmospheric physics, aurora polaris, meteorology, astronomy, high altitude atmospheric transmission program, the characteristics of infrared radiation from the earth, studies of airglow, size and height distribution of atmospheric aerosols, dust and noctilucent clouds, and many other phenomena. Many meteorological factors are discussed in detail. *Subject Headings:* **1. Satellite instrumentation 2. Upper atmosphere research. I. Setterholm, V. M. II. Troup, E. M.**—*N.N.* Ⓢ

11J–186 551.507.362.2

Von Braun, Wernher (*Dir., Development Operations Div., U. S. Army Ballistic Missile Agency, Reastone Arsenal, Ala*), **The Explorers.** *International Astronautical Congress, Amsterdam, Aug. 1958, Proceedings*, Vol. 2: 914–931, issued **1959.** 10 figs. **DLC** (TL787.144) Also in: *Astronautica Acta*, Vienna, 5(2):126–143, **1959.** 10 figs. **DWB**—The paper presents the description of the scientific earth satellites of the Explorer series and their launching vehicles. The first section gives information about the carrier rockets and their firing procedure. This is followed by the description of the instruments carried to collect scientific data. The Explorer I was furnished with several

instruments designed to determine the amount of micrometeorites, cosmic radiation and temperature in the space. For more complete data gathering Explorer III carried a tape recorder, which reported on command the stored information. Explorers I and III found heavier cosmic ray radiation at high altitudes than had been predicted. The instrumentation in Explorer IV and V was designed to investigate this phenomenon more closely. These new instruments are capable of detecting radiation accurately up to the range of 60,000 particles per square centimeter per second. When this paper was prepared, Explorer IV was sitting on its launching pad, and Explorer V was in the checkout hangar. The further treatment of the topic covers the firing operations. *Subject Headings:* **1. Satellite uses 2. International astronautical congresses 3. U. S. satellites.**—*E.K.* Ⓢ

11J–187 551.507.362.2:551.521

Wackernagel, Hans Beat, **Das Satellitenprojekt.** [The satellite project.] *Leben und Umwelt*, Basel, 12(7):160–162, April **1956.** 2 figs. **DWB**—Account of the suggested MOUSE satellite, to which the U. S. project is probably similar. Diagrams (labelled in English) are given of the orbit and instrumentation. From such a satellite much could be learned about solar corpuscular radiation, micrometeorites, earth albedo, etc. (*Same item as* 8.1–26, Jan. 1957, *Met. Abstr.*) *Subject Headings:* **1. Satellite observatories 2. Radiation research.**—*C.E.P.B.*

11J–188 629.19:061.3

†Watson, G. D. (*Canadian Defence Res. Board*), **Scientific exploration of space.** *Canadian Aeronautical Journal*, Ottawa, 6(3):81–89, March **1960.** 15 figs., 24 refs. **DLC**—A general survey of the scientific exploration of space—methods, problems, achievements and motivation are reviewed. Terminology now commonly used is explained. Photographs show earth with its weather cover, the far side of the moon, sunspot penumbra, and a Canadian infrared nose cone. Schematic drawings illustrate Explorer VII and Lunik III, the position of Van Allen belts, solar system orbits, earth orbital characteristics and space probe orbits. Some Canadian experiments are mentioned. *Subject Heading:* **1. Space research.**—*E.Z.S.* Ⓢ

11J–189 551.507.362.2:551.509.39:629.19

Wexler, Harry, **Observing the weather from a satellite vehicle.** Presented at the 3rd Symposium on Space Travel, New York, May 4, **1954.** *British Interplanetary Society, Journal*, 13:269–276, **1954.** 2 figs. **DLC**—Clouds of a depression seen from above are described. Requirements for locating and tracing cloud systems from a satellite are set out. The proposed satellite circles the earth (pole to pole) in 4 hrs at a height of 4000 mi. View from such a satellite is described, including atmospheric systems. This could be transmitted automatically; other observations would be possible from a manned satellite. (*Same item as* 6.11–123, Nov. 1955, *Met. Abstr.*) *Subject Headings:* **1. Satellite observatories 2. Weather satellites.**—*C.E.P.B.*

11J–190 551.507.362.2

Wexler, Harry, **Satellites and meteorology: a report to the World Meteorological Organization.** Wash., D. C., March 31, **1959.** 17 p. 13 refs. Mimeo. **DWB** (M07.362.2 U587sa)—Weather satellites can be used to locate cloud areas or storms in the vast areas without sounding stations, to determine the radiation balance of the earth and conditions in the top half of the atmosphere. Orbits of large eccentricity, useful in some studies, should be avoided for weather investigations. The polar and the equatorial orbits are discussed with respect to their relative merits and the optimum heights and equipment. Communication satellites might play a role in world-wide weather map preparation. Coordination on an international level, between the various ICSU (COSPAR) and WMO committees and those of IAV, IUGG, URSI, etc. is discussed and recommendations of COSPAR to WMO listed. (*Same item as* 10.10–97, Oct. 1959, *Met. Abstr.*) *Subject Headings:* **1. Satellite observatories 2. Weather satellites.**—*M.R.*

11J–191 551.507.362.2

Wexler, Harry, **Satellites and meteorology.** *World Meteorological Organization, WMO Bulletin*, 9(1):2–7, Jan. **1960.** 3 figs., 4 refs. **DWB, DLC**—Weather charts, introduced a century ago, have improved with communication. The invention of meteorological satellites to orbit the earth and obtain information on the activities of the major storms and to measure cloud cover and global distribution of net radiant energy has become an added convenience for the meteorologist. His horizon expands in the areas of advanced atmospheric physics, and his satellites are capable of measuring the various characteristics of the atmosphere. The great flow of data which will pour forth from satellites and the large number of important problems to whose solution they will contribute make it important that compilations or world charts of important elements be drawn up and made available to research groups everywhere. *Subject Headings:* **1. Weather satellites 2. Weather observations.**—*E.K.* Ⓢ

11J–192 551.507.362.2:551.576.11

Wexler, Harry and Fritz, Sigmund (*both, U. S. W. B.*), **Tiros reveals cloud formations.** *Science,* Wash., D. C., 131(3415):1708–1710, June 10, **1960.** 7 photos, 2 refs. **DLC**—Tiros I, the experimental weather satellite, took about 9000 pictures of various cloud formations during the first month since its launching date, April 1, 1960. The paper presents 7 pictures of cloud vortices with fine descriptions. The observations revealed a large degree of organization in the cloud system. It was found that spiral cloud bands were associated with large storms of about 1000 mi in diameter. *Subject Headings:* **1. Weather satellites 2. U. S. satellite, 1960 Beta (Tiros I) 3. Cloud systems.** —*E.K.* Ⓢ

11J–193 551.510.534:551.507.362.2

Wexler, Raymond (*Allied Res. Assoc., Inc.*), **Detection of ozone amounts from satellite measurements.** *U. S. Air Force. Cambridge Research Center, GRD Research Notes,* No. 36:181–189, June **1960.** 2 figs., table, 15 eqs. **DWB**—A discussion of the determination of ozone amounts from a satellite by measuring the scattered radiation from an atmospheric column at two different wave lengths. This method, suggested by SINGER, is employed in an effort to determine the theoretical ratios of radiation intensities to be expected at the two wave lengths. *Subject Headings:* **1. Ozone distribution in upper atmosphere 2. Satellite uses.**—*I.S.* Ⓢ

11J–194 551.521.18:551.507.362.2

Wexler, Raymond (*Allied Res. Assoc., Inc.*), **Satellite observations of infrared radiation.** *U. S. Air Force. Cambridge Research Center, GRD Research Notes,* No. 36:153–180, June **1960.** 13 figs., 3 tables, 13 eqs. **DWB**—A discussion of the proposed meteorological satellites carrying several infrared sensing elements intended to provide information on the infrared properties of the atmosphere. From available experimental data on absorptions by atmospheric gases, atmospheric transmissions in the infrared have been determined. The actual amounts of radiation which may be expected to leave the top of the atmosphere over the U. S. on a specific occasion (March 6, 1959, 0900Z) are mapped for the "window" regions, the 6.3μ H_2O, the 15μ, the 4.3μ CO_2 and ozone bands. For the H_2O band, computations are made at air masses (secant of the zenith angle) for zenith angles of 0°, 60° and 81.5°. *Subject Headings:* **1. Infrared radiation measurement techniques 2. Satellite observation of infrared.**—*I.S.* Ⓢ

11J–195 551.507.362.2:551.510.53:551.510.3

*Whipple, F. L.; Boyd, L. G.; Hynek, J. A. and Schilling, G. F., (*comps.*), **Orbital data and preliminary analyses of Satellites 1957 Alpha and 1957 Beta.** *Smithsonian Contributions to Astrophysics,* Wash., D. C., 2(10):189–346, **1958.** "Consists mostly of *Special Reports,* No. 1–10, issued by *Smithsonian Institution Astrophysical Observatory* on its *IGY Project* No. 30.10, Oct. 15, 1957–March 1, **1958.**" (For listing of contents, *see* Pt. III, 9(8):1045, Aug. 1958.) **DWB, DLC**—A preliminary report on the activities of the world-wide network of observatories and prediction stations set up for the tracking of the two U.S.S.R. satellites 1957 Alpha and 1957 Beta. On a Mercator projection of the world, the trajectory of satellite 1957 Alpha is drawn. Preliminary values of the upper atmosphere density from the observations of the two satellites are calculated for the respective perigeal altitudes. Atmospheric density at altitudes between 220 km and 230 km is observed to be higher than was expected. This tentative procedure of calculating such a density is believed to be of great value for calculating the influence of atmospheric density over a world-wide range of altitudes. A glossary of astronomical terms for the description of satellite orbits is included. *Subject Headings:* **1. Satellite orbits 2. Soviet satellite, 1957 Alpha (Sputnik I) 3. Soviet satellite, 1957 Beta (Sputnik II).**—*N.N.*

11J–196 551.510.535:551.506.7-551.507.362.2

Whitney, Charles A. (*Astrophysical Obs., Smithsonian Inst., Harvard Coll. Obs.*), **The structure of the high atmosphere, Pt. 1, Linear models.** *Smithsonian Institution. Astrophysical Observatory, Special Report,* No. 21:1–12, Feb. 27, **1958.** Fig., 4 tables, 13 refs., 3 eqs. **DWB**—Reprinted in *IGY,* 1957/1958. *IGY World Data Center A [for] Rockets and Satellites, IGY Satellite Report Series,* No. 8:103–114, June 15, **1959. Pt. 2, A conduction model.** *Ibid., Special Report,* No. 25:1–6, April 20, **1959.** 2 figs., 2 tables, 3 refs., 14 eqs. **DWB.** Reprinted in *IGY* 1957/1958. *IGY World Data Center A [for] Rockets and Satellites, IGY Satellite Report Series,* No. 8:115–121, June 15, **1959.**—In Pt. 1, the structure of the terrestial atmosphere above 100 km is discussed as inferred from data from artificial satellites. To infer atmospheric densities near the perigee heights of the satellites, orbital accelerations derived by analyses performed at the Smithsonian Astrophysical Observatory were employed. The paper presents a homogeneous set of mean satellite data and fits three simple models to the inferred densities. The models are based on sectionally-linear distributions of molecular temperature. In Pt. 2, the author attempts to construct a conduction model,

based on NICOLET's discussion (1958) which outlined several aspects of physical models for the high atmosphere. The treatment of the subject matter is divided into four sections: 1) algebraic description of the conduction model, 2) construction of the model, 3) domain of failure of the conductive atmosphere and 4) conclusion that through adjustment of parameters, the conductive model can be made consistent with present satellite data. The temperature distribution above 250 km is still open to considerable uncertainty insofar as direct evidence from satellite data is concerned. *Subject Headings:* **1. Upper atmosphere structure 2. Atmospheric models 3. Satellite data.**—*E.K.*

11J–197 551.509.3:551.507.362.2

Widger, William K., Jr. and Touart, C. N. (*both, A. F. Camb. Res. Ctr.*), **Utilization of satellite observations in weather analysis and forecasting.** *American Meteorological Society, Bulletin*, 38(9):521–533, Nov. **1957.** 8 figs., 19 refs. **DWB, DLC**—The authors discuss the possible application of satellite data to weather analysis and forecasting within the reasonable foreseeable future. The usefulness of satellites depends upon their orbital altitudes and is limited by the fact that they are outside the atmosphere being observed. The meteorological observations are visual (clouds, cloud movements, drift of atmospheric pollutants, state of sea surface, visibility and snow cover); radiometric (albedo, temperature of a level near it or near the tropopause, total moisture content, total ozone content and surface or ground-air interface, temperature), and radar observations. Data transmission and data processing, and the manner in which the information is provided by satellites in weather analysis and forecasting are discussed. The possible information relevant to weather analysis that can be provided by cloud data (types, movement, etc.), surface wind data, tropopause temperature, etc. is summarized. A simplified and idealized example illustrating a weather analysis based upon satellite data is presented. Finally, the authors discuss a program for simulating data obtained from satellites by means of rockets and aircraft flights, and utilizing such simulated data for forecasts, and appraise the value of satellite data in practical meteorology. (*Same item as* 10.4–125, April 1959, *Met. Abstr.*) *Subject Headings:* **1. Satellite data 2. Weather analysis 3. Weather forecasting.**—*I.L.D.*

11J–198 551.507.362.2

†Widger, William K., Jr. (*ed.*), **Contributions to satellite meteorology, by John J. Aiken, John H. Conover et al.** *U. S. Air Force. Cambridge Research Center, GRD Research Notes*, No. 36, June **1960.** 263 p. figs., tables, 42 refs. (For listing of articles, *see* Pt. III, p. 1361, Aug. 1960, *Met. Abstr.* These articles abstracted separately.) **DWB**—This collection of papers presents and discusses the results of the investigations in the field of satellite meteorology being conducted by the Satellite Meteorology Branch of the Atmospheric Circulations Laboratory, Geophysics Research Directorate. The six chapters cover: I, Introductory remarks; II, survey of the applications of meteorological satellites; III, visual observations of cloud systems and cloud patterns; IV, methods for geographically locating the pictures of the earth and clouds; V, observations in the infrared and ultraviolet spectra; VI, various steps and processes that must be considered in designing a system for the over-all reduction and processing of satellite meteorological data. *Subject Headings:* **1. Satellite meteorology 2. Satellite uses.**—*I.S.* Ⓢ

11J–199 551.557.2:551.507.362.2

Widger, William K., Jr. (*Geophysics Research Directorate*), **Generalized, schematic flow-chart for the reduction and processing of satellite meteorological data.** *U. S. Air Force. Cambridge Research Center, GRD Research Notes*, No. 36:191–203, June **1960.** fig. **DWB**—A discussion of the various types of steps and of transformations that must be considered in designing a system for the reduction and processing of satellite meteorological data. A flow-chart of schematic data reduction and processing system is given and discussed. *Subject Headings:* **1. Weather satellites 2. Satellite data 3. Flow-charts.**—*I.S.* Ⓢ

SUPPLEMENTARY MATERIAL

11J–200 551.507.362.2:551.576.1

Bristor, Charles L. and Ruzecki, Mary Ann (*both, U. S. W. B., Wash., D. C.*), **TIROS I photographs of the midwest storm of April 1, 1960.** *Monthly Weather Review*, Wash., D. C., 88(9/12):315–326, Sept./Dec. **1960.** 11 figs., 6 refs. **DWB, DLC**—The midwest cyclone of April 1, 1960 is described from the standpoint of a series of TIROS cloud photographs. Cloud features having different appearances are related to the air masses and mechanisms involved. The cloud pictures are also used in outlining a possible application for objective weather map analysis in sparse data regions. *Subject Headings:* **1. Weather satellites 2. U. S. satellite, 1960 Beta (Tiros I) 3. Cloud photography.**—*Authors' abstract.* Ⓢ

11J–201 551.507.362.2:778.3:551.515.11(266)

Winston, Jay S. (*U. S. W. B., Wash., D. C.*), **Satellite pictures of a cut-off cyclone over the Eastern Pacific.** *Monthly Weather Review*, Wash., D. C., 88(9/12):295–314, Sept./Dec. **1960.** 21 figs., 9 refs. **DWB, DLC**—TIROS I photographs taken near the most intense stage of a cut-off cyclone over the eastern Pacific are examined relative to the standard observations and analyses in the area. Broad cloud bands seen in the southwestern portions of the cyclone have been found to be nearly perpendicular to the wind direction at both the surface and aloft, and to consist mainly of cumuliform cloudiness whose tops did not extend more than about 5,000 ft above the sea surface. Examination of the photographs relative to the conventional frontal analysis and to vertical motions computed by a numerical prediction model suggests that satellite cloud pictures can lead to improvements in the standard analyses of surface and upper-air charts. *Subject Headings:* **1. Weather satellites 2. U. S. satellite, 1960 Beta (Tiros I) 3. Cut-off cyclones 4. Cloud photography 5. Eastern Pacific.**—*Author's abstract.* Ⓢ

PART III. RECENT MONOGRAPHS AND ANALYTICS FROM SERIALS AND COLLECTED WORKS

Note: Material listed in these sections will not be included in the monthly indexes until abstracted. The item number is mentioned for those titles which have been abstracted in previous issues of **Meteorological and Geoastrophysical Abstracts.**

A. RECENT MONOGRAPHS

Booth, A. E.: **Microwave data tables.** London, Iliffe & Sons, Ltd., 1959. 61 p. Price 26 sh 6d.

Brillouin, Léon: **Wave propagation and group velocity.** N. Y., London, Academic Press, Inc., 1960. 154 p. 53 figs. Price 48 sh.

Godwin, Felix: **Exploration of the solar system.** N. Y., Plenum Press, 1960. 200 p. Price 35 sh. DLC (TL793.G6) Review by D. G. King-Hele in *Nature*, London, 187(4740):811, Sept. 3, 1960

Hoff, N. J. and Vincenti, W. G. (eds.): **Aeronautics and astronautics: Proceedings of the Durand Centennial Conference, held Stanford Univ.** London, Pergamon Press, (1960?). Price $12.00. Includes 19 papers of Conference.

Hutchings, Edward, Jr. (ed.): **Frontiers in science.** London, George Allen & Unwin, 1960. 362 p. 42 figs. Price 25 sh.

Jacobs, J. A.; Russell, R. D. and Wilson, J. T.: **Physics and geology.** N. Y., McGraw-Hill, 1959. 424 p. 12 figs. Price 76 sh. Review by F. Steinhauser in *Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A*, Vienna, 11(4):543–544, 1960.

Jastrow, Robert (ed.): **Exploration of space.** N. Y., Macmillan, 1960. 160 p. Price $5.50. "Papers presented at a 1959 Symposium. Contributions by James Van Allen, Homer E. Newell, G. P. Kuiper and Harold Urey."

Koniaev, Petr Grigor'evich: **V verkhnikh sloiakh atmosfer** [In the upper atmosphere]. Belgrad, Belgorodskoe Knizhnoe Izd-vo, 1959. 60 p. Illus., bibliog. DLC (QC879.K64)

Milne-Thomson, L. M.: **Theoretical hydrodynamics.** 4th ed. London, Macmillan; N. Y., St. Martin's Press, 1960. 660 p. plates, numerous figs. Price 65 sh. (*For abstract on 3rd ed., see* 9.4–7, April 1958, *Met. Abstracts*)

Ratcliffe, J. A. (ed.): **Physics of the upper atmosphere.** N. Y., Academic Press, 1960. 586 p. figs., tables, refs., eqs. DWB (M10.R233ph)

Seaborg, Glenn T. and Valens, Evans G.: **Elements of the universe.** N. Y., Dutton; London, Methuen, 1959. 253 p. figs. Price 28 sh.

Shepard, Francis P.: **The earth beneath the sea.** Baltimore, Johns Hopkins Press, (1960?). Price $5.00

Slater, J. C.: **Microwave transmission.** Unabridged reprint. N. Y., Dover Publications, Inc.; London, Constable, 1959. 309 p. 76 figs. Price 12 sh.

Soviet Research in Geophysics (in English translation), Vol. 1 (A collection of articles on dynamic meteorology), issued 1960 by Consultants Bureau, N. Y. for the American Geophysical Union. (This is a transl. of the original Russian, **Sbornik statei po dinamicheskoĭ meteorologii,** issued as *Akademiia Nauk SSSR. Geofizicheskiĭ Institut, Trudy*, No. 37(164), 1956.) *For listing of original Russian articles, see* Vol. 8: 1558, Nov. 1957, *Met. Abstracts.*

Teich, Martin: **Kleine Wetterkunde** [Pocket meteorology]. Verlag Sport und Technik, 1959. 64 p. illus. (*ABC des Fliegens*, Vol. 4.) DLC (TL556.T4)

B. ARTICLES APPEARING IN RECENTLY ISSUED PUBLICATIONS

Acta Meteorologica Sinica, Peking, Vol. 25, No. 3, 1954

Koo, Chen-chao: **Predstavlenie i kritika metodov vychisliaiushchikh vertikal'nuiu skorost' bol'shogo masshtaba v atmosfere,** [Presentation and criticism of methods for calculating large scale vertical velocity in the atmosphere], p. 147–163

Yang, Chien-ch'u: **Issledovanii Sovetsikh uchonykh k voprosu vlagooborata,** [Investigations by Soviet scientists on the problem of moisture exchange], p. 165–181

Chen, C. M. and Ma, S. C.: **The relation between the micro-climate near the ground and plants in the West suburb Peking,** p. 183–193
Hsü, Shu-ying; Hsu, Mong-ying and Kao, Yu-hsie: **The climate of Hai-nan Island,** p. 195–212
Chen, Hau-yaw: **The analysis of two situations concerning the generation and development of cyclones over the eastern China Sea,** p. 213–232

Vol. 25, No. 4, 1954

Dao, Shih-yen and Liao, Tung-hsien: **Application of the advective-dynamic analysis of U.S.S.R. in weather forecasting in eastern Asia,** p. 233–251
Hsu, E. H.: **Notes on Kibel's forecasting equations,** p. 253–277
Yeh, Tu-cheng: **Production of kinetic energy in the atmosphere,** p. 279–289
Soh, Hsin-pei: **On a proposed method for the computation of the upper-air tendency field,** p. 291–294
Soh, Hsin-pei: **New method of forecasting based on Kibel's fundamental assumptions,** p. 295–298

Vol. 27, No. 1, 1956

Hsieh, Yi-ping et al.: **A preliminary survey of certain rain-bearing systems over China in spring and summer,** p. 1–23
Kuei, P'ei-lang: **Karta tsirkuliatsii krupnogo masshtaba v Vostochnoĭ Azii pri poiavlenii antitsiklona v raĭone Urala (osen'iu, zimnoĭ, vesnoĭ),** [A large scale map of circulation in E. Asia during the appearance of an anticyclone in the Urals region (autumn, winter, spring)], p. 25–35
Yang, Chien-chu: **The mean monthly changes of air mass of the Northern Hemisphere,** p. 37–59
Li, Ch'i-shen: **Zamechanie o uluchshenii metoda izmereniia vertikal'nykh dvizheniĭ v svobodnoĭ atmosfere s pomoshch'iu grebenchatogo radiozonda,** [Note on the improvement of the method of measuring vertical currents in the free atmosphere by means of the radiosonde], p. 61–68
Koo, Chen-chao: **O metode skhematicheski resheniia integral'nogo vikhrevogo uravneniia atmosfery,** [A method of schematically solving the integral vorticity equation for the atmosphere], p. 69–72

Vol. 31, No. 2, 1960

Tu, Hsing-yüan: **Ob uchete vliianiia vysokogornykh plato pri chislennom prognoze izobaricheskikh poverkhnosteĭ,** [Taking into account the influence of high mountain plateaus in the numerical forecasting of isobaric surfaces], p. 93–100
Hsu, E. H.: **On the approximate solution to Helmholtz equation,** p. 101–109
Chang, S. C. and Ting, S. C.: **A preliminary discussion on a synthetic method of forecast,** p. 110–118
Chyou, Yung-yen: **A proposed quantitative forecasting of frontal precipitation,** p. 119–125
Chien, Lieh-ting and Li, Yu-lan: **Issledovanie sinopticheskikh usloviĭ ekstremal'no teplykh i ekstremal'no kholodnykh sinopticheskikh periodov v kholodnykh polugodiĭ v Pekinskoĭ oblasti,** [Investigation of synoptic conditions during extremely warm and extremely cold synoptic periods in winter in the Peking region], p. 126–137
Hwang, Shih-sung; Tang, Ming-min et al.: **A method of predicting long period sequences of synoptic processes by single station data,** p. 138–149
Lo, Se-we: **Osobennosti osrednennykh tsirkuliatsiĭ letom i zimoĭ i ikh preobrazovaniia nad Tibetskim plato za 1957–1959 gg.,** [Characteristics of averaged summer and winter circulations and their modification over the Tibetan plateau from 1957–1959], p. 150–158
Liu, Chen-hsing: **The regularity of the atmosphere turbulent exchange in the surface layer,** p. 159–170
Liao, Roung-sun: **A discussion on the formulas of the coefficient of the moisture circulation,** p. 171–180

Akademiia Nauk SSSR, Izvestiia Ser. Geofizich., No. 2, Feb. 1960

Gzovskiĭ, M. V.; Krestnikov, V. N.; Nersesov, I. L. and Reĭsner, G. I.: **Novye printsipy seĭsmicheskogo raĭonirovaniia na primere tsentral'noĭ chasti Tian'-Shania. I.,** [New principles in seismological classification, the central Tien Shan taken as an example, Pt. 1], p. 177–194
Gal'perin, E. I. and Frolova, A. V.: **Azimutal'no-fazovaia korreliatsiia seĭsmicheskikh voln, poliarizovannykh po ellipsu,** [Azimuth-phase correlation of seismic waves polarized along the ellipse], p. 195–208

Gol'tsman, F. M.: **Chastotnaia teoriia interferentsionnykh sistem. II,** [Frequency theory of interferential systems, Pt. 2], p. 209–222

Ivanova, T. G.: **Ob ispol'zovanii chastotnogo seĭsmicheskogo zondirovaniia dlia izucheniia verkhneĭ chasti razreza,** [Use of frequency seismic sounding for the upper part of a profile], p. 223–228

Fogel', A. A.: **Avtomatika na seĭsmicheskikh stantsiiakh Severo-Tian'-Shan'skoĭ zony,** [Automation at seismic stations of the northern Tien Shan zone], p. 229–235

Kalashnikov, A. G. and Zybin, K. Iu.: **Nekotorye rezul'taty nabliudeniĭ vektora variatsiĭ gorizontal'noĭ sostavliaiushcheĭ geomagnitnogo polia (po nabliudeniiam MGG),** [Certain results of observations of the vector variations of the horizontal component of the geomagnetic field (according to IGY observations)], p. 236–242

Levin, B. Iu. and Maeva, S. V.: **O termicheskoĭ istorii Zemli,** [The thermal history of the earth], p. 243–252

Bulashevich, Iu. P. and Shuliat'ev, S. A.: **Optimal'nye usloviia nepreryvnogo aktivatsionnogo karotazha,** [Optimum conditions for continuous activated core sampling], p. 253–262

Voskoboĭnikov, G. M.: **K teorii interpretatsii dannykh gamma-karotazha v sloistykh sredakh,** [Theory of the interpretation of gamma-soundings in stratified media], p. 263–270

Salikhov, A. G. and Stepanov, V. P.: **O plotnosti i gravitatsionnom effekte porod paleozoia territorii Tatarskoĭ respubliki,** [Density and gravitational effect of Paleozoic deposits in the Tatar Republic], p. 271–277

Fedorov, K. N.: **Sezonnye izmeneniia okeanicheskikh techeniĭ,** [Seasonal variations of ocean currents], p. 278–287

Malkevich, M. S.: **Priblizhennyĭ metod ucheta gorizontal'nykh izmeneniĭ al'bedo podstilaiushcheĭ poverkhnosti v zadachakh o rasseianii sveta v atmosfere,** [Approximate method of accounting for the horizontal changes of the albedo of the underlying surface in problems of light scattering in the atmosphere], p. 288–298

Feĭgel'son, E. M.: **Rol' turbulentnosti v protsesse radiatsionnogo vykholazhivaniia oblakov,** [Role of turbulence in radiational cooling of clouds], p. 299–308

Komarov, N. N.: **Voprosy rascheta neustanovivshikhsia tokov v izmeritel'nykh kondensatorakh schetchikov ionov i ionnykh spektrometrov,** [Problems of calculating unstabilized currents in measuring condensors of ion counters and ion spectrometers], p. 309–317

Levshin, A. L.: **Interpretatsiia dannykh o dispersii poverkhnostnykh voln s pomoshch'iu bilogarifmicheskikh paletok teoreticheskikh dispersionnykh krivykh,** [Interpretation of data on the dispersion of surface waves with the aid of bilogarithmic templets of theoretical dispersion curves], p. 318–322

Fremd, V. M.: **O vozmozhnosti primeneniia mnogostupenchatogo zagrubleniia seĭsmografov,** [Possibility of multistep reduction of the sensitivity of seismographs], p. 323–325

Parkhomenko, E. I. and Bondarenko, A. T.: **Vliianie odnostoronnego davleniia na elektricheskoe soprotivlenie gornykh porod,** [Influence of unilateral pressure on the electrical resistance of rocks], p. 326–332

Kalinin, V. A.: **Deformatsiia zapolnennykh elektronnykh obolochek atomov i ionov pri bol'shikh vsestoronnikh davleniiakh,** [Deformation of filled electron shells of atoms and ions at high surrounding pressures], p. 333–336

Ovchinnikov, I. K.: **Raschet perekhodnogo soprotivleniia tsilindricheskogo zazemleniia v skvazhine,** [Calculation of the transient resistance of cylindrical grounding in a borehole], p. 337–338

Baiandina, F. I.: **O raznosti potentsialov, voznikaiushcheĭ mezhdu tverdoĭ i zhidkoĭ fazoĭ pri zamerzanii vody,** [Potential difference between the solid and the liquid phase during the freezing of water], p. 339–340

Gruza, G. V.: **O mezhdushirotnom teploobmene v severnom polusharii,** [Interlatitudinal heat exchange in the Northern Hemisphere], p. 341–345

Bulgakov, N. P.: **O iavlenii uplotneniia pri smeshenii vod,** [Increase in density during the mixing of waters], p. 346–352

No. 3, March 1960

Gzovskiĭ, M. V.; Krestnikov, V. N.; Nersesov, I. L. and Reĭsner, G. I.: **Novye printsipy seĭsmicheskogo raĭonirovaniia na primere tsentral'noĭ chasti Tian'-Shania. II,** [New principles of seismic classification as exemplified by the central part of the Tien Shan], p. 353–370

Kogan, S. D.: **Vremena probega prodol'nykh i poperechnykh voln, vychislennye po dannym iadernykh vzryvov, proizvedennykh v raĭone Marshallovykh ostrovov,** [Travel times of longitudinal and transverse waves computed from the data of nuclear explosions in the region of the Marshall Islands], p. 371–380

Meĭ, Shi-yun: **O seĭsmichskoĭ aktivnosti Kitaia,** [Seismic activity in China], p. 381–395

Sorokhtin, O. G.; Kondrat'ev, O. K. and Avsiuk, Iu. N.: **Metodika i osnovnye rezul'taty seĭsmicheskikh i gravimetricheskikh issledovaniĭ stroeniia vostochnoĭ Antarktidy,** [Methods and principal results of seismic and gravimetric investigations on the structure of eastern Antarctica], p. 396–401

Liustikh, E. N.: **Energiia obrazovaniia zemnoĭ kory,** [Energy released during the formation of the earth's crust], p. 402–408

Leonov, N. N.: **Khaitskoe zemletriasenie 1949 g. i geologicheskie usloviia ego vozniknoveniia,** [The Khait earthquake of 1949 and its geological causes], p. 409–424

Kitaĭgorodskiĭ, S. A.: **O raschete tolshchiny sloia vetrovogo peremeshivaniia v okeane,** [Calculation of the thickness of the layer in which wind-induced mixing occurs in an ocean], p. 425–431

Obukhov, A. M.: **O statisticheski ortogonal'nykh razlozheniiakh empiricheskikh funktsiĭ,** [Statistically orthogonal expansion of empirical functions], p. 432–439

Malkevich, M. S.: **O vliianii neortotropnosti podstilaiushcheĭ poverkhnosti na rasseiannyĭ svet v atmosfere,** [Effect of unorthotropic underlying surfaces on the scattering of light in the atmosphere], p. 440–448

Muliarchik, T. M.: **Interferometricheskie izmereniia temperatury verkhneĭ atmosfery po shirine nekotorykh emissionnykh liniĭ,** [Interferometric temperature measurements of the upper atmosphere based on the width of some emission lines], p. 449–458

Komarov, N. N.: **Nekotorye rezul'taty issledovaniia neustanovivshikhsia tokov v schetchikakh ionov,** [Some results of a study of transient currents in ion counters], p. 459–466

Karmaleeva, R. M.: **Popytka prognoza blizkikh zemletriaseniĭ vo vremeni,** [An attempt to forecast the imminence of earthquakes], p. 467–474

Glivenko, E. V.: **Ob opredelenii prelomliaiushcheĭ granitsy po dannym azimutal'noĭ stantsii,** [Locating the refracting boundary by azimuthal station records], p. 475–481

Fremd, V. M.: **Datchik s fotosoprotivleniem dlia seĭsmicheskikh stantsiĭ,** [Transmitter with a photoresistor for seismic stations], p. 482–483

Pudovkin, M. I.: **Istochniki bukhtoobraznykh vozmushcheniĭ,** [Sources of bay type disturbances], p. 484–489

Brodskaia, S. Iu. and Grabovskiĭ, M. A.: **Ob odnoĭ iz prichin nesovpadeniia vektora ostatochnoĭ namagnichennosti gornoĭ porody s napravleniem namagnichivaiushchego polia,** [One cause of the deviation of the vector of residual rock magnetism from the direction of the magnetizing field], p. 490–494

Nikitina, V. N.: **Raschety peremennogo elektromagnitnogo polia nad naklonnym plastom,** [Calculation of alternating electromagnetic fields over inclined seams], p. 495–506

Avaste, O. A. and Atroshenko, V. S.: **O tochnosti metoda V. V. Soboleva,** [The accuracy of V. V. Sobolev's method], p. 507–509

Shuĭskaia, F. K.: **O Spektrakh poliarnykh siianiĭ,** [Auroral spectra], p. 510–512

No. 5, May 1960

Savarenskiĭ, E. F.; Kondorskaia, N. V. and Belotelov, V. L.: **Ob opredelenii energii uprugikh voln, porozhdaemykh zemletriaseniem,** [Determination of energy in elastic waves generated by earthquakes], p. 633–643

Kogan, S. Ia.: **Ob opredelenii energii seĭsmicheskikh voln proizvol'noĭ formy,** [Determining the energy in seismic waves of arbitrary form], p. 644–652

Bagdoev, A. G.: **Opredelenie davleniia v okrestnosti fronta,** [Pressure determination in the region of the wave front], p. 653–657

Kun, V. V.: **Osobennosti seĭsmicheskikh voln v sredakh s vertikal'nymi granitsami razdela, (Po model'nym issledovaniiam),** [Characteristics of seismic waves in media with vertical interfaces (according to model studies)], p. 658–670

Briunelli, B. E.; Raspopov, O. M. and Ianovskiĭ, B. M.: **Mikrovariatsionnaia stantsiia LGU i rezultaty ee raboty v Borke vesnoĭ 1959 g.,** [Microvariation station of Leningrad University and results of its work at the "Borok" Geophysical Station in the spring of 1959], p. 671–679

Kogan, R. M.: **O statistike radioaktivnykh prevrashcheniĭ atomnykh iader, obrazuiushchikh semeĭstvo,** [Statistics of radioactive transformation of atomic nuclei constituting a family], p. 680–687

Glinskiĭ, N. T.: **O vertikal'nykh kolevaniiakh temperatury vody v Chernom more,** [Vertical fluctuations of water temperature in the Black Sea], p. 688–697

Malakhov, S. G.; Kirdin, G. S.; Kovda, A. V. and Sisigina, T. I.: **O prostranstvennykh i vremennykh kolevaniiakh estestvennoĭ radioaktivnosti atmosfery,** [Spatial and temporal variations of natural atmospheric radioactivity], p. 698–706

Pudovkina, I. B. and Katsyka, A. P.: **Izmereniia elektricheskikh zariadov iskusstvennykh tumanov i estestvennykh oblakov,** [Measuring electric charges in artificial fogs and natural clouds], p. 707–713

Dzhordzhio, N. V.: **Fotoelektricheskie nabliudeniia pul'siruiushchikh form poliarnykh siianiĭ,** [Photoelectric observation of pulsating auroras], p. 714–719

Stepanov, V. P.: **Magnitnoe anomal'noe pole Tatarskoĭ ASSR i ego sviaz' s geologicheskim stroeniem,** [The magnetic anomaly field of the Tatar A.S.S.R. and its relation to geological structure], p. 720–724

Pariĭskaia, G. N. and Kun, V. V.: **Ob otnositel'noĭ intensivnosti golovnykh voln, rasprostraniaiushchikhsia v sredakh s vertikal'nymi granitsami razdela,** [Relative intensity of head waves propagating in media with vertical boundary surfaces], p. 725–732

Gavrilov, L. I.: **Gravitatsionnyĭ potentsial ellipticheskogo paraboloida,** [Gravitation potential of elliptic paraboloids], p. 733–735

D'iakonov, B. P.: **Vliianie poverkhnosti Zemli na elektromagnitnoe pole tsilindricheskoĭ neodnorodnosti,** [Effect of the earth's surface on the electromagnetic field of cylindrical inhomogeneity], p. 736–742

Barsukov, O. M.: **Tri "skorosti" korpuskuliarnykh potokov iz khromosfernykh vspyshek,** [The three "velocities" of corpuscular streams from chromospheric flares], p. 743–745

Rykov, A. V.: **Primenenie magnitnogo moduliatora i rezonansnogo usilitelia v pribore dlia zapisi potoka energii seĭsmicheskikh voln,** [Use of magnetic modulators and resonance amplifiers in apparatus recording the energy flow of seismic waves], p. 746–750

Popov, E. I.: **O zavisimosti spolzaniia nul'punkta kvartsevykh gravimetrov ot tolshchiny niteĭ uprugoĭ sistemy,** [Dependence of zero creep in quartz gravimeters on the thickness of fibers in the elastic system], p. 751–752

Pogorelov, V. I. and Martvel', F. E.: **Nekotorye rezul'taty odnovremennykh fotograficheskikh i radiolokatsionnykh nabliudeniĭ poliarnykh siianiĭ,** [Some results of simultaneous photographic and radar observations of polar auroras], p. 753–755

Antonova, L. A. and Ivanov-Kholodnyĭ, G. S.: **Opyt izmereniia korpuskuliarnogo izlucheniia v verkhneĭ atmosfere,** [Measurement of corpuscular radiation in the upper atmosphere], p. 756–757

Karol', I. L.: **O gipoteze kvazistatsionarnogo prizemnogo sloia v teorii turbulentnoĭ diffuzii tiazhelogo aerozolia v pogranichnom sloe atmosfery,** [The hypothesis of a quasi-stationary layer near the earth's surface in the theory of turbulent diffusion of heavy aerosols in the boundary layer of the atmosphere], p. 758–761

Zamorskiĭ, A. D.: **Oshibki odnoĭ stat'i,** [Errors of an article], p. 762–763

Knigi po fiziko-matematicheskim naukam Izdatel'stva Akademii nauk SSSR, namechennye k vypusku v 1960 g., [Books on physical-mathematical sciences published by the Academy of Sciences of the U.S.S.R. to be issued in 1960], p. 764–767

Akademiia Nauk SSSR, Izvestiia, Ser. Geograficheskaia, No. 3, March 1960

Budyko, M. I. and Tsitsenko, G. V.: **Klimaticheskie faktory teplooshchushcheniia cheloveka,** [Climatic factors of heat perception by a human organism], p. 3–11

Dobrovol'skiĭ, A. D. and Leont'eva, V. V.: **Osnovnye svedeniia po gidrologii okeanicheskikh vpadin Tikhogo okeana,** [Hydrology of the Pacific deeps], p. 12–25

Liakhov, M. E.: **K kharakteristike klimaticheskikh zon tsentral'noĭ chasti Tikhogo okeana (Po nabliudeniiam vo vremia reĭsa na "Vitiaze"),** [Climatic zones of the Central Pacific (observations made on the "Vitiaz" cruise)], p. 71–74

Nadëzhin, V. M.: **Izmenenie solenosti glubinnykh vod Basseĭna Belogo Moria,** [Salinity variations of deep waters in the White Sea], p. 79–84

Spiridonova, Iu. V.: **Soveshchanie po probleme Solntse-Troposfera,** [The conference on the problem Sun-troposphere], p. 157–159

American Astronautical Society, Advances in the Astronautical Sciences, Vol. 5. (Proceedings of the 2nd Western National Meeting of the Society, Los Angeles, Calif. Aug. 4–5, 1959. N. Y., Plenum Press, 1960)

Imus, Henry A.: **Human factors in probing outer space,** p. 15–24

Trapp, Robert F. and Konecci, Eugene B.: **Shielding and nuclear propulsion,** p. 25–32

Kuehnegger, Walter: **The reaction control simulator: a flight trainer for manned orbital and space vehicles,** p. 33–38

deCallies, Richard N.: **Human factors in spacecraft technology,** p. 39–50

Breakwell, John V.: **Fuel requirements for crude interplanetary guidance,** p. 53–65

Kierstead, Friend H., Jr.: **Guidance requirements for interplanetary flight,** p. 66–81
FitzGibbon, Mary C.: **Satellite orbit control system,** p. 82–97
Benedikt, E. T.: **Scientific significance of deep space exploration,** p. 98–115
Ross, Robert E.: **Dynamic response surfaces for nonlinear equations of rocket-powered flight,** p. 116–137
Cornog, Robert: **Design optimization of thermal radiators for space vehicles,** p. 141–148
Sailor, J. Douglas: **Solar photovoltaic power sources for space vehicles,** p. 149–156
Fisher, Edward: **The problem of electrical neutrality in ion beams,** p. 157–165
Kunen, Alfred E. and McIlroy, W.: **The magnetic pinch engine for space flight,** p. 166–178
Johnson, Paul G. and Smith, Roger L.: **Round-trip trajectories for Mars observation,** p. 181–205
Nicks, O. W.: **A systematic approach to a matrix of space research vehicles,** p. 206–217
Swanson, Robert S. and Petersen, Norman: **The influence of launch conditions on the friendly rendezvous of astrovehicles,** p. 218–236
Stalony-Dobrzanski, J.: **Effect of reentry technique on the design of a space vehicle,** p. 237–247
Vilbig, Friedrich: **Global communication using passive or active satellite relay stations,** p. 251–260
Child, C. H.: **Requirements for data transmission from a Martian Reconnaissance Vehicle,** p. 261–277
Goodman, Nathaniel Roy: **Measuring amplitude and phase,** p. 278–290
Viterbi, A. J.: **Design techniques for space television,** p. 291–305
Alzofon, Frederick E.: **The origin of the gravitational field,** p. 309–319
Alexandrov, Igor: **The lunar gravitational potential,** p. 320–324
Gedeon, Geza S.: **An analytical method for determining the orbital characteristics of a nonlifting body which passes through the lower atmosphere of a planet,** p. 325–337
Jastrow, Robert: **Lunar and terrestrial atmospheres,** p. 338–345
Rutowski, R. W. and Chan, K. K.: **Shock tube experiments simulating entry into planetary atmospheres,** p. 346–356

Arctic, Montreal, Vol. 13, No. 2, June 1960

Haumann, Dieter: **Photogrammetric and glaciological studies of Salmon Glacier,** p. 75–110
Clark, Don B.: **A strain gauge technique for the dynamic measurement of ice,** p. 123–131

Astronautics, N. Y., Vol. 5, No. 5, May 1960

Davies, Merton E.: **How good is Lunik III photography?,** p. 28–29
Mesner, Max H. and Staniszewski, J. R.: **Television cameras for space exploration,** p. 36–37

Vol. 5, No. 6, June 1960

Sternberg, Sidney and Stroud, William G.: **Tiros I—meteorological satellite,** p. 32–34, 84–86
Freeman, John D.: **Tiros I timer,** p. 35, 78–79
Goldberg, E. A. and Landon, V. D.: **Key equipment for Tiros I,** p. 36–37, 98–99
Perkel, Harold: **Tiros I spin stabilization,** p. 38–39, 106
Ritter: Milton: **Thermal design for Tiros,** p. 40–41, 92–96
Osgood, Carl C.: **Structural design of Tiros I,** p. 42–43, 90–91
Keigler, John E. and Oakley, Charles B.: **Tiros system on the ground,** p. 44–45, 100–102

Astrophysical Journal, Chicago, Vol. 131, No. 3, May 1960

Zirker, J. B.: **The energy balance of opaque atmospheres,** p. 684–689
Jefferies, J. T.: **Thermally broadened Stark profiles of some high Balmer lines,** p. 690–694
Jefferies, J. T. and Thomas, R. N.: **The source function in a non-equilibrium atmosphere, Pt. 5, Character of the self-reversed emission cores of Ca^+ H and K,** p. 695–704
Athay, R. Grant: **The equilibria and ultraviolet spectra, H, He I, and He II in the solar atmosphere,** p. 705–716
Zirin, Harold and Tandberg-Hanssen, Einar: **Physical conditions in limb flares and active prominences, Pt. 4, Comparison of active and quiescent prominences,** p. 717–724
Swarup, G.; Stone, P. H. and Maxwell, A.: **The association of solar radio bursts with flares and prominences,** p. 725–738
de Turville, Claude: **A note on continuous creation,** p. 741–742

Ciel et Terre, Brussels, Vol. 76, No. 1/2, January/February 1960

De Vuyst, A.: **Sur les connaissances actuelles du géomagnétisme,** [Present knowledge in geomagnetism], p. 1–20

Buyse, C.: **Les aurores et leurs relations avec certaines observations radioélectriques,** [Auroras and their relations with certain radioelectric observations], p. 36–41

Koeckelenbergh, A.: **Activité solaire en 1958,** [Solar activity during 1958], p. 43–52

Deep-Sea Research, N. Y., Vol. 6, No. 1, October 1959

Ichiye, Takashi: **On long waves in a stratified, equatorial ocean caused by a travelling disturbance,** p. 16–37

Vol. 6, No. 2, Feb. 1960

Lisitsin, A. P. and Zhivago, A. V.: **Marine geological work of the Soviet Antarctic Expedition, 1955–1957,** p. 77–87

Kriss, A. E.: **Micro-organisms as indicators of hydrological phenomena in seas and oceans, Pt. 1, Methods,** p. 88–94

Wolff, Torben: **The hadal community, an introduction,** p. 95–124

McGowan, John A.: **The relationship of the distribution of the planktonic worm,** *Poecobius meseres Heath,* **to the water masses of the North Pacific,** p. 125–139

Stommel, Henry and Arons, A. B.: **On the abyssal circulation of the world ocean, Pt. 1, Stationary planetary flow patterns on a sphere,** p. 140–154

Swallow, J. C. and Hamon, B. V.: **Some measurements of deep currents in the Eastern North Atlantic,** p. 155–168

Nordstrom, S. G. and Folsom, T. R.: **Suggestion for eliminating pressure effects on protected reversing thermometers,** p. 169

Hersey, J. B.: **Acoustically monitored bottom coring,** p. 170–172

Vol. 6, No. 3, April 1960

Kriss, A. E.; Lebedeva, M. N. and Mitzkevich, I. N.: **Micro-organisms as indicators of hydrological phenomena in seas and oceans, Pt. 2, Investigation of the deep circulation of the Indian Ocean using microbiological methods,** p. 173–183

Stommel, Henry and Arons, A. B.: **On the abyssal circulation of the world ocean, Pt. 2, An idealized model of the circulation pattern and amplitude in oceanic basins,** p. 217–233

Wüst, Georg: **Proposed International Indian Ocean Oceanographic Expedition, 1962–1963,** p. 245–249

Robinson, Margaret K.: **Indian Ocean vertical temperature sections,** p. 249–258

Vol. 6, No. 4, June 1960

Wooster, Warren S.: **Investigations of equatorial undercurrents,** p. 263–264

Knauss, John A.: **Measurements of the Cromwell Current,** p. 265–286

Arthur, Robert S.: **Review of the calculation of ocean currents at the equator,** p. 287–297

Stommel, Henry: **Wind-drift near the Equator,** p. 298–302

Charney, Jule G.: **Non-linear theory of a wind-driven homogeneous layer near the equator,** p. 303–310

Robinson, Allan R.: **General thermal circulation in equatorial regions,** p. 311–317

Veronis, G.: **An approximate theoretical analysis of the equatorial undercurrent,** p. 318–327

Neumann, Gerhard: **Evidence for an equatorial undercurrent in the Atlantic Ocean,** p. 328–334

Kriss, A. E.; Abyzov, S. S. and Mitzkevich, I. N.: **Micro-organisms as indicators of hydrological phenomena in seas and oceans, Pt. 3, Distribution of water masses in the central part of the Pacific Ocean (according to microbiological data),** p. 335–345

Dansgaard, W.: **Content of heavy oxygen isotope in the water masses of the Philippine Trench,** p. 346–350

Menzel, D. W. and Ryther, J. H.: **Annual cycle of primary production in the Sargasso Sea off Bermuda,** p. 351–367

Iskusstvennye Sputniki Zemli, [Artificial Earth Satellites], Moscow, No. 4, 1960

Kislik, M. D.: **Dvizhenie iskusstvennogo sputnika v normal'nom gravitatsionnom pole Zemli,** [Movement of an artificial satellite within the earth's normal gravitational field], p. 3–17

El'iasberg, P. E. and Iastrebov, V. D.: **Opredelenie plotnosti verkhneĭ atmosfery po rezul'tatam nabliudeniĭ za poletom tret'ego sovetskogo iskusstvennogo sputnika Zemli,** [Determination of the density of the upper atmosphere according to flight observations of the third Soviet artificial earth satellite], p. 18–30

Kolegov, G. A.: **Variatsii plotnosti verkhneĭ atmosfery po sannym ob izmenenii periodov obrashcheniia iskusstvennykh sputnikov Zemli,** [Variations in the density of the upper atmosphere according to data on the changes of rotation periods of artificial earth satellites], p. 31–34

Iatsunskiĭ, I. M.: **Opredelenie usloviĭ osveshchennosti i vremeni prebyvaniia iskusstvennogo sputnika v teni i na solntse,** [Determining the illumination conditions of an artificial satellite and the length of time it is in the shade and in sunlight], p. 35–42

Eneev, T. M.; Platonov, A. K. and Kazakova, R. K.: **Opredelenie parametrov orbity iskusstvennogo sputnika po dannym nazemnykh izmereniĭ,** [Determining the parameters of an artificial satellite orbit using ground measurement data], p. 43–55

Taratynova, G. P.: **Metody chislennogo resheniia uravneniĭ v konechnykh raznostiakh i ikh primenenie k raschetam orbit iskusstvennykh sputnikov Zemli,** [Techniques of numerical solution of finite difference equations and their application to computations of artificial satellite orbits], p. 56–81

Lur'e, A. I.: **Uravneniia vozmushchennogo dvizheniia v zadache Keplera,** [Equations of disturbed motion in Kepler's problem], p. 82–85

Staniukovich, K. P.: **Elementy teorii udara tverdykh tel s bol'shimi (kosmicheskimi) skorostiamii,** [Principles of the theory of the impact of solid bodies with great (cosmic) velocities], p. 86–117

Mirtov, B. A.: **Meteornaia materiia i nekotorye voprosy geofiziki vysokikh sloev atmosfery,** [Meteoric matter and some problems in the geophysics of upper atmospheric layers], p. 118–134

Dolginov, S. Sh.; Zhuzgov, L. N. and Seliutin, V. A.: **Magnitometricheskaia apparatura tret'ego sovetskogo iskusstvennogo sputnika Zemli,** [Magnetometric equipment of the third Soviet artificial satellite], p. 135–160

Shvarts, Ia. M.: **Metod opredeleniia elektricheskogo potentsiala tel, pomeshchennykh v plazme,** [Determination of the electric potential of bodies placed in a plasma], p. 161–164

Nazarova, T. N.: **Issledovanie meteornykh chastits na tret'em sovetskom iskusstvennom sputnike Zemli,** [Study of meteoric particles on the third Soviet artificial earth satellite], p. 165–170

Istomin, V. G.: **Nekotorye rezul'taty izmereniia spektra mass polozhitel'nykh ionov na tret'em sovetskom iskusstvennom sputnike Zemli,** [Some results of the measurement of the mass spectrum of positive ions on the third Soviet artificial earth satellite], p. 171–183

Shafer, Iu. G. and Iarygin, A. V.: **Izmerenie kosmicheskikh lucheĭ na geofizicheskikh raketakh,** [Cosmic ray measurements from geophysical rockets], p. 184–194

Shklovskiĭ, I. S.: **Iskusstvennaia kometa kak metod opticheskikh nabliudeniĭ kosmicheskikh raket,** [Artificial comet as a method of optical observations of space rockets], p. 195–204

No. 5, 1960

Sedov, L. I.: **Orbity kosmicheskikh raket v storony Luny,** [Space rocket orbits in the direction of the moon], p. 3–15

Dolginov, S. Sh.; Eroshenko, E. G.; Zhuzgov, L. N.; Pushkov, N. V. and Tiurmina, L. O.: **Magnitnye izmereniia na vtoroĭ kosmicheskoĭ rakete,** [Magnetic measurements on the second space rocket], p. 16–23

Vernov, S. N.; Chudakov, A. E.; Vakulov, P. V.; Logachev, Iu. I. and Nikolaev, A. G.: **Izmereniia radiatsii pri polete vtoroĭ kosmicheskoĭ rakety,** [Radiation measurements during the flight of the second space rocket], p. 24–29

Kurnosova, L. V.; Logachev, V. I.; Razorenov, L. A. and Fradkin, M. I.: **Issledovanie kosmicheskikh lucheĭ pri polete vtoroĭ kosmicheskoĭ rakety na Lunu,** [Cosmic ray investigations during the flight of the second space rocket to the moon], p. 30–37

Nazarova, T. N.: **Rezul'taty issledovaniia meteornogo veshchestva s pomoshch'iu priborov, ustanovlennykh na kosmicheskikh raketakh,** [Results of the study of meteoric matter conducted by instruments installed in space rockets], p. 38–40

Raushenbakh, B. V. and Tokar', E. N.: **Nekotorye voprosy upraveleniia v mezhplanetnom prostranstve,** [Some problems of guidance in interplanetary space], p. 41–53

Gurko, O. V.: **Opredelenie uslovii vidimosti kosmicheskikh raket,** [Determining visibility conditions for space rockets], p. 54–59
Danilov, A. D.: **K voprosu ob obrazovanii NO^+ v verkhneĭ atmosfere,** [Formation of NO^+ in the upper atmosphere], p. 60–65
Kuperov, L. P.: **Nabliudeniia za signalami tret'ego sovetskogo iskusstvennogo sputnika Zemli na myse Cheliuskina,** [Observations of the signals of the third Soviet artificial earth satellite on Cape Cheliuskin], p. 66–70
Iatsunskiĭ, I. M. and Gurko, O. V.: **Izmenenie al'bedo pervogo iskusstvennogo sputnika Zemli v rezul'tate vozdeĭstviia vneshnikh faktorov,** [Changes in the albedo of the first artificial earth satellite due to the effect of external factors], p. 71–73

Japan. Meteorological Agency, Quarterly Journal of Seismology, Vol. 24, No. 2, March 1960

Sekiya, H.: **An analysis of volcanic activity of Mt. Asama, Pt. 2, On volcanic activity in 1958,** p. 91–101
Noguchi, T.: **On the types of seismograms obtained at Takamatsu,** p. 103–108
Kusanagi, J. and Ishibashi, S.: **Investigation for the estimation of the origin of earthquakes from the observations at Hachinobe,** p. 109–113
Hamamatsu, O.: **Relations between the distribution of epicenters and the direction of initial motion of earthquakes observed at Tokyo,** p. 115–122

Journal of Geomagnetism and Geoelectricity, Kyoto, Vol. 11, No. 3, 1960

Rikitake, Tsuneji: **Electromagnetic induction in a hemi-spherical ocean by *Sq*.,** p. 65–69
Obayashi, Tatsuzo: **Physical state of outer atmosphere and the origin of radiation belts,** p. 80–84

Mariners Weather Log, Wash., D. C., Vol. 4, No. 3, May 1960

Truppi, Lawrence E.: **Local rain warning by marine radar,** p. 57–60
Typhoons of the western North Pacific, 1959, p. 60–66

Vol. 4, No. 4, July 1960

Cox, Joel B.: **The hurricane voyage of the yacht Esprit,** p. 99–101
Clark, Gilbert B.: **Hurricane tracking at sea,** p. 102–103
Oak, W. W.: **Opening of Great Lakes navigation, 1960,** p. 103–104

Meteorological Bulletin, Taipei, Formosa, Vol. 1, No. 1, March 1955

Hsü, Ying-ching: **Applied report of the weather types in China,** p. 1–2
Chi, C. H.: **On the relationship between general circulation and variation of precipitation in summer and winter in Formosa,** p. 3–16
Wang, Shih-ting: **Forecasting of monsoon in winter in Formosa,** p. 17–23
Yin, Lai-chao: **On the study of typhoon forecasting,** p. 24–26
Shen, Chüan-chieh: **On the nature of jet stream,** p. 27–35
Hsü, Ying-ching: **Introduction to the method for chart forecasting,** p. 36–38

[Vol. 6], No. 1, March 1960

Liao, Shyue-yih: **A discussion of meteorological disasters in Taiwan,** p. 1–29
Report on typhoon "Joan," p. 30–37
Report on typhoon "Louise," p. 38–42
Report on typhoon "Freda," p. 43–46

Monthly Weather Review, Wash., D. C., Vol. 88, No. 5, May 1960

Hoecker, Walter H., Jr.: **Wind speed and air flow patterns in the Dallas tornado of April 2, 1957,** p. 167–180
Lokke, Donald H.: **Jet condensation trail shadows,** p. 181

Wark, D. Q. and Popham, R. W.: **Tiros I observations of ice in the Gulf of St. Lawrence,** p. 182–186

Armstrong, C. L. and Garrett, R. D.: **High altitude wind data from meteorological rockets,** p. 187–190

Ogden, D. E. and Swinton, D. B.: **ARCAS temperature data in the mesosphere,** p. 191–192

Andrews, James F.: **The weather and circulation of May 1960: including a discussion of the unusual retrogression of 5-day mean polar vortices,** p. 193–202

Moscow. Tsentral'nyĭ Institut Prognozov, Sbornik metodicheskikh ukazaniĭ po analizu i otsenke slozhivshikhsia i ozhidaemykh agrometeorologicheskikh uslovii [Collection of methodological instructions on the analysis and evaluation of existing and expected agrometeorological conditions], Leningrad, Gidrometeoizdat, 1957

Shigolev, A. A.: **Metodika sostavleniia fenologicheskikh prognozov,** [Method of making phenological forecasts], p. 5–18

Razumova, L. A.: **Metodika sostavleniia prognoza zapasov produktivnoĭ vlagi pochve k nachaly vegetatsionnogo perioda,** [Method of forecasting productive soil moisture reserves for the beginning of the vegetative period], p. 19–27

Zubarev, N. A.: **Skorost' prorastaniia semian i sroki poiavleniia vskhodov zernovykh kul'tur pri razlichnykh agrometeorologicheskikh usloviiakh,** [Speed of seed germination and time of sprouting of grain crops under various agrometeorological conditions], p. 28–48

Protserov, A. V.: **Otsenka vlagoobespechennosti iarovoĭ pshenitsy (ovsa i iachmenia) v period vegetatsii,** [Evaluation of moisture available to summer wheat (oats and barley) during the vegetation period], p. 49–53

Kontorshchikov, A. S.: **Raschet summarnogo isparenia vlagi s poleĭ iarovoĭ pshenitsy,** [Calculation of the total moisture evaporation from summer wheat fields], p. 53–56

Kulik, M. S.: **Otsenka zasushlivykh iavlenii,** [Evaluation of drought phenomena], p. 57–83

Mastinskaia, S. B.: **Metodika sostavleniia agrometeorologicheskogo prognoza srokov i norm poliva iarovoĭ pshenitsy,** [Method of making agrometeorological forecasts of the time and amount of watering necessary for summer wheat], p. 83–92

Ulanova, E. S.: **Metodika otsenki slozhivshikhsia i ozhidaemykh agrometeorologicheskikh uslovii razvitiia i rosta ozimykh v osenniĭ period,** [Method of evaluating present and expected agrometeorological conditions for the development and growth of winter crops in autumn], p. 93–105

Petunin, I. M.: **Metodika sostavleniia prognoza uslovii perezimovki ozimoĭ pshenitsy i rzhi** [Method of forecasting wintering conditions for winter wheat and rye], p. 105–129

Moiseĭchik, V. A.: **Otsenka agrometeorologicheskikh uslovii perezimovki ozimykh posevov,** [Evaluation of agrometeorological conditions for the wintering of winter crops], p. 129–142

Verigo, S. A.: **Metodika sostavleniia prognoza zapasov produktivnoĭ vlagi v pochve i otsenka vlagoobespechennosti zernovykh kul'tur,** [Method of forecasting the reserves of productive moisture in the soil and evaluation of the moisture available to grain crops], p. 143–164

Protserov, A. V.: **Otsenka agrometeorologicheskikh uslovii perioda uborki zernovykh kul'tur kombaĭnom,** [Evaluation of agrometeorological conditions during the harvesting of grain crops with a combine], p. 165–174

Popovskaia, O. M.: **Metodika otsenki agrometeorologicheskikh uslovii proizrastaniia kartofelia v tsentral'nykh oblastiakh Evropeĭskoĭ territorii SSSR,** [Method for evaluating agrometeorological conditions for the growth of potatoes in the central regions of the European U.S.S.R.], p. 175–195

Mastinskaia, S. B.: **Sostavlenie prognoza zapasov produktivnoĭ vlagi v pochve pod kartofelem i mnogoletnimi travami,** [Forecasting the reserves in productive soil moisture under potatoes and perennial grasses], p. 196–210

Kontorshchikova, O. M.: **Otsenka vodoobespechennosti posevov sakharnoĭ svekly,** [Evaluation of the moisture available for sugar beets], p. 211–222

Pobetova, T. A.: **Metodika prognoza agrometeorologicheskikh uslovii razvitiia i srokov sozrevaniia tomatov,** [Method of forecasting agrometeorological conditions for the development and ripening of tomatoes], p. 223–225

Babushkin, L. N.: **Otsenka vliianiia pogody na skorost' razvitiia khlopchatnika i metodika sostavleniia agrometeorologicheskikh informatsii i prognozov nastupleniia osnovnykh faz razvitiia ego v usloviiakh Uzbekistana,** [Evaluation of the influence of weather on the speed of development of cotton and methods of obtaining agrometeorological information and forecasting the beginning of its main phases of development under conditions in Uzbekistan], p. 226–260

Pfeffer, Richard L. [ed.] Dynamics of climate: the Proceedings of a Conference on the Application of Numerical Integration Techniques to the Problem of the General Circulation, held Oct. 26–28, 1955. Sponsored jointly by Institute for Advanced Study, Princeton, N. J. and Geophysics Research Directorate, Air Force Cambridge Research Center, Air Research and Development Command. N. Y., Pergamon Press, 1960.

Von Neumann, John: **Some remarks on the problem of forecasting climatic fluctuations,** p. 9–11

Charney, Jule G.: **Numerical prediction and the general circulation,** p. 12–17

Phillips, Norman A.: **The general circulation of the atmosphere: a numerical experiment,** p. 18–25

Pfeffer, Richard L.: **On the design of a numerical experiment for the study of the general circulation of the atmosphere,** p. 26–31

Mintz, Yale: **On the incorporation of non-adiabatic effects in numerical integration models for the study of the general circulation,** p. 32–36

Eliassen, Arnt: **Remarks on the problem of long-range weather prediction,** p. 37–43

Smagorinsky, Joseph: **A synopsis of research on quasi-stationary perturbations of the mean zonal circulation caused by topography and heating,** p. 44–49

Starr, Victor P.: **Some comments on the general circulation and plans of the M.I.T. project for studies of the general circulation by numerical methods,** p. 53–57

Benton, George S.: **A review of research conducted by the general circulation project at the Johns Hopkins University,** p. 58–66

Bjerknes, Jacob: **Ageostrophic corrections to the computed poleward flux of angular momentum,** p. 67–70

Fultz, Dave: **Experimental models of rotating fluids and possible avenues for future research,** p. 71–77

Kuo, Hsiao-Lan: **Theoretical findings concerning the effects of heating and rotation on the mechanism of energy release in rotating fluid systems,** p. 78–85

Lorenz, Edward N.: **Generation of available potential energy and the intensity of the general circulation,** p. 86–92

Wexler, Harry: **Possible causes of climatic fluctuations,** p. 93–95

Fritz, Sigmund: **The heating distribution in the atmosphere and climatic change,** p. 96–100

Kaplan, Lewis D.: **Problems involved in introducing long-wave radiative effects into mathematical models of the atmospheric circulation,** p. 103–107

King, Jean I.: **A potential theory formulation of radiant-heat transfer,** p. 108–112

Sovetskaia Antarkticheskaia Ekspeditsiia, 1955–, Vtoraia Morskaia Ekspeditsiia na d/e "Ob'" 1956–1957 gg.: Obshchee opisanie i nauchnye resul'taty, [Soviet Antarctic Expedition, 1955–, Second Sea Expedition of the Diesel Electric Ship "Ob," 1956–1957: General description and scientific results], Leningrad, Izdat-vo Morskoĭ Transport, 1959. (Its [Materialy], Vol. 5.)

Maksimov, I. V.: **Vtoraia morskaia antarkticheskaia ekspeditsiia,** [The second Antarctic Sea Expedition], p. 7–18

Man, I. A.: **Vtoroe plavanie dizel'-elektrokhoda "Ob',"** [The second cruise of the diesel-electric ship "Ob"], p. 19–26

Khromov, S. P.: **Atmosfernaia tsirkuliatsiia i pogoda na puti "Ob'" v plavanii 1956–1957 gg.,** [Atmospheric circulation and weather en route during the voyage of the "Ob" in 1956–1957], p. 27–83

Gutnikov, V. P.: **Sinopticheskie protsessy v iuzhnom polusharii,** [Synoptic processes in the Southern Hemisphere], p. 84–100

Sobolev, L. G.: **Raboty aerometeorologicheskogo otriada,** [The work of the aerometeorological party], p. 101–105

Moroshkin, K. V.: **Gidrologicheskie issledovaniia,** [Hydrological investigations], p. 106–123

Moroshkin, K. V. and Bogdanov, M. A.: **Rezul'taty primeneniia elektromagnitnogo izmeritelia techeniĭ v Indiĭskom okeane i iuzhnoĭ chasti Tikhogo okeana,** [Results of the use of the geomagnetic electrokinetograph in the Indian Ocean and the southern part of the Pacific Ocean], p. 124–137

Morozov, A. P.: **Nabliudeniia nad morskim volneniem,** [Observations in rough seas], p. 138–143

Gordeev, Iu. A.: **Gidrograficheskie raboty,** [Hydrographical work], p. 144–153

Tomashunas, B. Ia.: **Ledovye nabliudeniia,** [Ice observations], p. 154–158

Bogoiavlenskiĭ, A. N.: **Gidrokhimicheskie issledovaniia,** [Hydrochemical investigations], p. 159–172

Kutiurin, V. M.: **Opredelenie soderzhaniia khlorofilla v morskoĭ vode i spektral'nyĭ analiz pigmentov fitoplanktona,** [Determination of chlorophyll content in sea water and the spectral analysis of phytoplankton pigments], p. 173–175

Vsesoiuznoe Geograficheskoe Obshchestvo SSSR, Izvestiia, Vol. 92, No. 3, May/June 1960

Gavrilov, A. M.: **O vliianii karsta na stok malykh rek,** [The influence of karst on the drainage of small rivers], p. 251–262

Maksimov, E. V.: **Aganakattinskiĭ uzel sovremennogo oledeneniia v Dzhungarskom Alatau,** [The Aganakatta center of contemporary glaciation in the Dzhungarian Ala Tau], p. 263–272

Malinina, T. I.: **Odnouzlovaia seĭsha Iakimvarskogo zaliva Ladozhskogo ozera,** [Uninodal seiche of the Yakkimvar bay (Ladoga lake)], p. 274–276

Zakharova, A. F.: **Oleg Alekseevich Drozdov (K piatidesiatiletiiu so dnia rozhdeniia),** [O. A. Drozdov: on his fiftieth anniversary], p. 277–278

PART IV. AUTHOR AND SUBJECT INDEXES

In this section will be found reference to the number given at the head of each abstract or entry. In Part I each entry begins with the number 11.10 and in Part II in the Bibliography on Satellite Meteorology each entry begins with the number and letter 11J. This index is divided into three parts:

Index of Authors | Index of Subjects | Index of Geographic Locations

INDEX OF AUTHORS

Aagard, R. L., 11.10–238
Ångström, A. K., 11.10–236
Abbott, W. N., 11J–1
Adams, F. D., 11.10–12
Adel, A., 11.10–88
Aiken, J. J., 11J–2
Akademiia Nauk SSSR, 11.10–57
Akasofu, Syun-Ichi, 11.10–215
Alaska Univ. Geophysical Inst., 11.10–166
Allied Research Associates, Inc., Boston, 11.10–245
Al'pert, Ia. L., 11J–3
Alterman, Z., 11.10–279
American Geophysical Union, 11J–4, 11J–5, 11J–6, 11J–7, 11J–8, 11J–9
Anderson, B., 11.10–9
Anderson, K. A., 11.10–217
Appleton, E. V., 11.10–3
Arakawa, H., 11.10–23, 11.10–127
Ariz. State College, Flagstaff, Ariz., 11.10–88
Arneson, A. D., 11.10–367
Arnowitz, L., 11J–10
Ashwell, I. Y., 11.10–298
Aujeszky, L., 11J–11

Babcock, H. W., 11.10–76
Bachmann, H., 11.10–73
Bagariatskiĭ, B. A., 11.10–164
Bahng, J. D., 11.10–64
Bain, W. C., 11.10–111
Ballif, J. R., 11.10–263
Baroni, A., 11J–12
Bartman, F. L., 11J–81
Basler, R. P., 11J–13
Bates, D. R., 11.10–261, 11J–14, 11J–15
Batrakov, Iu. V., 11.10–33
Beletskiĭ, V. V., 11.10–34
Belik, N. I., 11.10–4
Benioff, H., 11.10–199
Bennett, H. E., 11.10–314
Bennewitz, H. G., 11J–137
Bergeron, T., 11.10–254
Berkner, L. V., 11J–16
Berlage, H. P., 11J–17
Berthold, W. K., 11.10–204
Bibl, K., 11.10–140
Bigg, E. K., 11.10–357
Billings, D. E., 11.10–87
Bird, D. L., 11.10–31
Blackwell, D. E., 11.10–223
Blamont, J. F., 11.10–189
Bleeker, W., 11.10–274, 11.10–281, 11.10–289, 11.10–303
Bless, R. C., 11.10–165
Blue Hill Meteorological Obs., 11J–49
Bochníček, Z. V., 11J–18
Boggess, R. L., 11J–150
Bosanquet, C. H., 11J–19
Bowman, G. G., 11.10–141, 11.10–142
Boyd, L. G., 11J–195
Boyd, R. L. F., 11J–20, 11J–21
Bray, R. J., 11.10–70
Brekke, K., 11.10–92
Bristor, C. L., 11J–200
Brockman, M. H., 11.10–40
Brooks, H. B., 11.10–297
Brundidge, H. T., 11J–22
Brunt, D., 11.10–13
Buchanan, H. R., 11.10–40
Budai, Et., 11.10–293
Budyko, M. I. (*ed.*), 11.10–1
Buedeler, W., 11J–23
Bugrov, B. G., 11.10–57
Bunker, A. F., 11.10–277
Burkard, O., 11.10–97
Buskirk, E. R., 11.10–381

Caidin, M., 11J–24
Cap, F., 11.10–38
Carlson, H. N., 11.10–143
Carter, L. J., 11J–25
Cehak, K., 11.10–374
Chaffee, M., 11.10–295
Chakrabarty, S. K., 11.10–128
Challande, R., 11.10–257
Chamberlain, J. W., 11.10–187
Champion, K. S. W., 11J–109
Chandrasekhar, S., 11.10–2
Chapman, S., 11.10–14, 11.10–15
Chasson, R. L., 11.10–129
Cheatham, D. C., 11.10–42
Chicago Univ. Dept. of Met., 11.10–19
Choate, R. L., 11.10–40
Chubb, T. A., 11J–26
Chudakov, A. E., 11J–27
Chudesenko, E. F., 11J–3
Clark, J. F., 11J–29
Cole, K. D., 11.10–319
Colorado Univ. Upper Air Lab., 11.10–239
Contract AF 19(604)-545, 11J–150
Contract AF 19(604)-949, 11.10–232
Contract AF 19(604)-1517, 11.10–110
Contract AF 19(604)-1589, 11J–49
Contract AF 19(604)-1754, 11J–34, 11J–35
Contract AF 19(604)-1899, 11.10–239
Contract AF 19(604)-2177, 11.10–88
Contract AF 19(604)-2179,
Contract AF 19(604)-3493, 11.10–245
Contract AF 19(604)-3861, 11J–157
Contract AF 19(604)-3875, 11.10–143
Contract AF 19(604)-5892, 11J–101
Contract AF 61(052)-227, 11.10–105, 11.10–106
Contract AF 61(514)-905, 11.10–264
Contract AF 61(514)-1292, 11J–100
Contract DA-36-039, Sc-64676, 11.10–233

ontract NONR-2656(00), 11J–185
ook, A. F., 11.10–107
oulson, K. L., 11.10–2
orcuff, Y., 11.10–206
oulomb, J., 11.10–200
oulson, K. L., 11.10–315
oulthard, G. A., 11.10–301
ragg, T., 11.10–76
ressman, G. P., 11.10–249
rombie, D. D., 11.10–51
urtis, G. W., 11.10–81
urtis, H. W., 11.10–211

)amon, K. R., 11.10–43
)aniel, A. F., 11.10–52
)anilin, B. S., 11J–30, 11J–107
)ave, J. V., 11.10–2
)avis, T. N., 11.10–166
eBey, L. G., 11J–31
)ecker, M. T., 11.10–48
)eirmendjian, D., 11.10–316
)eland, R. J., 11.10–283
)eMastus, H., 11.10–75
)enisov, I. S., 11J–32
e Vaucouleurs, G., 11.10–67
)ewitt, R. N., 11J–13
)ietze, G., 11J–33
)inger, H. E., 11.10–207
)irmhirn, I., 11.10–377
)obriakova, F. F., 11J–3
)ogniaux, R., 11.10–224
)owden, R. L., 11.10–167, 11.10–324
)rimmel, J., 11.10–253
)rummond, A. J., 11.10–236
)ryden, W. A., 11J–34, 11J–35
)ubief, J., 11.10–8
)ue Rojo, A., 11J–36
)ütsch, H. W., 11.10–264
)uller, N. M., 11.10–138
)uncan, R. A., 11.10–168
)ungey, J. W., 11.10–3
)wyer, L. J., 11.10–59
)yce, R. B., 11.10–147

aston, R. L., 11J–37
berhardt, P., 11.10–125
fremov, A. I., 11J–103
geland, A., 11.10–197
ggleston, J. M., 11.10–42
hmert, A., 11.10–130
l'iasberg, P. E., 11.10–37, 11J–38, 11J–39
llis, G. R., 10–168
llis, G. R. A., 11.10–144, 11.10–168
shleman, V. R., 11.10–112
vans, S., 11.10–169
yfrig, R., 11.10–145

anselau, G., 11.10–192
arkel, W., 11.10–240
arley, D. T., Jr., 11.10–146
Faust, H., 11J–40, 11J–41, 11J–42, 11J–43
Fedorov, E. K., 11J–44, 11J–45
Fine, L. A., 11.10–163
Fisher, E. L., 11.10–332
Florence Univ., 11.10–105, 11.10–106
Florida State Univ. Dept. of Met., 11J–34, 11J–35
Folkart, B. M., 11J–164
Forbush, S. E., 11.10–131
Ford, P. W., 11.10–132
Forsyth, P. A., 11.10–170
France Bureau des Longitudes, 11.10–61
Franklin Institute, Philadelphia, 11J–46
Franklin, R. G., 11.10–31
Fredriksen, A., 11.10–147
Frenkiel, F. N., 11.10–329
Friedman, H., 11J–26
Friedrich, W., 11.10–54
Fritz, S., 11J–47, 11J–192
Fultz, D., 11.10–6

Gadomski, J., 11.10–101
Gadsden, M., 11.10–171
Galkin, A. M., 11.10–57
Gallet, R. M., 11.10–221
Garmire, G., 11.10–179
Gartlein, C. W., 11.10–165
Gast, P. R., 11J–48
Gergen, J. L., 11.10–226
Gilchrist, A., 11.10–251
Gillopé, G., 11.10–325
Girard, A., 11.10–234
Glaser, A. H., 11.10–245, 11J–49, 11J–50, 11J–51
Gledhill, J. A., 11.10–148
Gliddon, J. E. C., 11.10–149
Godoli, G., 11.10–83, 11.10–84
Godson, W. L., 11J–52
Goldberg, E. A., 11J–53
Goldshlak, A. L., 11J–54
Goldman, D. T., 11J–55
Gotaas, Y., 11.10–347, 11.10–348
Grammer, M., 11.10–22
Grant NSF Y/22.6/327, 11.10–166
Greenfield, H., 11.10–60
Greenfield, S. M., 11J–56, 11J–57, 11J–58, 11J–83
Grimminger, G., 11J–59
Groves, G. V., 11J–60, 11J–61, 11J–62, 11J–63
Gutman, L. N., 11.10–349
Gutnick, M., 11.10–338

Haarländer, H., 11.10–340
Hagen, J. P., 11J–64, 11J–65
Hagfors, T., 11.10–113
Hall, L. A., 11.10–43
Hannell, F. G., 11.10–298
Hansen, W., 11.10–341
Hare, F. K., 11.10–290
Harris, A. K., 11.10–204
Harris, I., 11J–66
Hasegawa, M., 11.10–195
Hatch, F. E., 11.10–245
Haviland, R. P., 11J–67
Heeger, A. J., 11.10–58
Heindsmann, T. E., 11.10–367
Heiser, P., 11.10–184
Helliwell, R. A., 11.10–208
Henry, P. M., 11.10–350
Herrinck, P., 11.10–150
Hewson, E. W., 11.10–233
Hibbs, A. R., 11J–68
Higgs, R., 11.10–305
Hines, C. O., 11.10–108
Hinkelmann, K., 11.10–250
Hinteregger, H. E., 11.10–43
Hoffman, J. H., 11.10–133
Hoffman, W. C., 11.10–151, 11.10–209
Holloway, L., 11J–69
Holmboe, J., 11.10–278
Hope, H. J., 11.10–204
Hopkins, D. M., 11.10–378
Horne, W., 11J–70
Huang, Chun-Ming, 11.10–152
Huff, F. A., 11.10–365
Huk, M. I., 11.10–5
Hulburt, E., 11.10–228
Hultqvist, B., 11.10–190, 11.10–191
Hunten, D. M., 11.10–173, 11.10–177
Hynek, J. A., 11J–195

Iampietro, P. F., 11.10–381
Iaremenko, L. N., 11.10–183
Iatsunskiĭ, I. M., 11J–71
Ikegami, F., 11.10–49
Imianitov, I. M., 11.10–44
Institute of Radio Engineers, 11J–72
International Ozone Conference, 11.10–21
Iskusstvennye Sputniki Zemli, 11.10–11
Israël, H., 11.10–362
Iwai, Akira, 11.10–213

Jacchia, L. G., 11J–74, 11J–75, 11J–76, 11J–78
Janes, H. B., 11.10–48
Janicki, W., 11J–73
Jansá Guardiola, J. M., 11.10–304
Jastrow, R., 11J–66, 11J–77, 11J–78, 11J–79, 11J–80
Jensen, E., 11.10–86
Johns Hopkins Univ. Lab of Astrophysics and Physical Met., 11.10–231
Johnson, D. S., 11J–110

Johnson, W. C., 11.10–211
Jones, A. V., 11.10–172, 11.10–173
Jones, L. M., 11J–81
Jones, L. W., 11.10–135
Journal of Scientific and Industrial Research, 11J–82

Kallmann, H. K., 11J–83, 11J–84
Kamiya, Y., 11.10–136
Kaplan, J., 11J–85
Kash, S. W., 11.10–29
Kasten, F., 11.10–362
Kaufman, H. R., 11.10–30
Kaufmann, P., 11.10–24
Kazmi, S. A. A., 11.10–196
Keigler, J. E., 11J–86
Kellogg, W. W., 11J–56, 11J–57, 11J–58, 11J–83, 11J–84
Kelly, J. J., 11J–87
Kendall, P. C., 11.10–149
Kepler, J., 11.10–22
Khastgir, S. R., 11.10–155, 11.10–156
King, J., 11J–178
King, Jean I. F., 11J–88
King-Hele, D. G., 11J–89, 11J–90, 11J–91, 11J–92, 11J–93
Kimball, D. S., 11.10–166
Kirde, K., 11.10–376
Knighting, E., 11.10–251
Koch, J. W., 11.10–153
Kolegov, G. A., 11J–94
Koshelenko, I. V., 11.10–363
Kosibowa, Stefania, 11.10–174
Krasovskiĭ, V. I., 11J–95, 11J–96
Kreiken, E. A., 11.10–120
Kuchai, S. A., 11J–97
Kuiper, G. P., 11.10–103
Kulkarni, R. N., 11.10–268
Kuo, H. L., 11.10–252
Kupperian, J., 11J–26
Kuznetsov, G. I., 11.10–265

Lal, D., 11.10–58
Landmark, B., 11.10–113
Landon, V. D., 11J–53
Landsberg, H. E., 11.10–343
Lassen, K., 11.10–175
Lauter, E. A., 11.10–47
Lavrent'ev, M. A., 11.10–117
Lawrie, J. A., 11.10–205
Legrand, J. P., 11.10–134
Leipnitz, H., 11.10–176
Lengrüsser, P., 11J–137
Leningrad. Glavnaia Geofizicheskaia Observatoriia, 11.10–1
Lettau, H. H., 11.10–282
Licht, A. L., 11.10–74
Lidov, M. L., 11J–98
Lilly, D. K., 11.10–275
London Imperial College of Science and Technology. Dept. of Met., 11J–100
London, J., 11J–99
Long, R. R., 11.10–271
Loughhead, R. E., 11.10–70
Louisnard, N., 11.10–234
Loveridge, W. D., 11.10–139
Lovering, J. F., 11.10–118
Lowe, A. B., 11.10–299
Lowry, W. P., 11.10–333
Lox, F. F. M., 11.10–243
Ludlam, F. H., 11J–100
Ludwig, F. L., 11J–101
Lumb, F. E., 11.10–369
Lytle, E. A., 11.10–177

McClain, E. P., 11.10–19
Macdonald, N. J., 11.10–320
McGrath, W. D., 11.10–266
McGuire, F. G., 11J–102
McGuire, J. B., 11.10–39
McKay, G. A., 11.10–299
McLean, D. J., 11.10–201
McNarry, L. R., 11.10–77
McNish, A. G., 11.10–193
Maeda, Hiroshi, 11.10–342
Magness, T. A., 11.10–39
Makjanić, B., 11.10–334
Maling, D. H., 11.10–231
Malkus, Joanne S., 11.10–294, 11.10–295
Malling, L. R., 11.10–40
Mandel'shtam, S. L., 11J–103
Manning, L. A., 11.10–109, 11.10–112
Manning, R., 11.10–81
Mariani, F., 11.10–178, 11.10–328
Marlier, G., 11.10–382
Martin, D. W., 11.10–267
Martin, H. A., 11J–104
Martin, J. H., 11.10–59
Maryland Univ. Dept. of Physics, 11J–157
Matsushita, S., 11.10–154
Maxwell, A., 11.10–179
Meade, R. T., 11.10–357
Mergentaler, J., 11.10–71
Merrill, H. J., 11J–105
Mertz, L., 11.10–63
Michigan Univ. Engineering Research Inst., 11.10–233, 11J–150
Miczaika, G. R., 11J–106
Mikhnevich, V. V., 11J–30, 11J–107
Miller, L. I., 11J–100
Millman, P. M., 11.10–107
Minnis, C. M., 11J–108
Minzneri, R. A., 11J–109
Mismé, P., 11.10–46
Möller, F., 11.10–317
Molina, F., 11.10–178
Monin, A. S., 11.10–276
Monteith, J. L., 11.10–312
Mook, C. P., 11.10–210, 11J–110
Mordy, W. A., 11.10–361
Moreland, W. B., 11.10–246
Morgan, M. G., 11.10–208, 11.10–211, 11.10–212
Mowbray, L., 11J–111
Muliarchik, T. M., 11.10–180, 11.10–181
Munk, W. H., 11.10–327
Murai, G., 11.10–370
Murray, R., 11.10–301
Musen, P., 11.10–36
Mustel', E. R., 11.10–85
Murty, Y. S. N., 11.10–155, 11.10–156

Nagle, R. E., 11J–101
Nakada, Y., 11.10–225
Namias, J., 11.10–292
National Academy of Sciences, 11.10–20
Nature, London, 11J–112
La Nature, Paris, 11J–113
Naturwissenschaftliche Rundschau, Stuttgart, 11.10–41, 11.10–55, 11J–114, 11J–115
Naugebauer, Marcia, 11.10–95
Naumann, H., 11.10–45
Neill, J. C., 11.10–365
Nekrasov, I. A., 11.10–313
Newell, H. E., Jr., 11J–116, 11J–117, 11J–118, 11J–119, 11J–120
Newkirk, G. A., 11.10–81
Newton, R. R., 11.10–65
Nicolet, M., 11.10–261, 11.10–262, 11J–121, 11J–122
Nier, A. O., 11.10–133
Nikandrov, V. Ia., 11.10–353
Nisbet, T. R., 11.10–53
Nonweiler, T. R. F., 11.10–32
Nordberg, W., 11J–168
Nordo, J., 11.10–252
Norinder, H., 11.10–387, 11.10–388
Norrish, R. G. W., 11.10–266
Novikov, A. I., 11.10–10

Oakley, C. B., 11J–86
Obayashi, Tatsuzo, 11.10–202, 11.10–216
Obukhov, A., 11J–28
O'Connell, D. J. K., 11.10–386
Odishaw, H., 11J–85
Ogata, Yoshiharu, 11.10–161
O'Mahony, G., 11.10–366
Omholt, A., 11.10–182
Ordway, F. I., 11J–123
Orlova, Z. P., 11.10–242
Osgood, C. C., 11J–124

steuropa-Naturwissenschaft, Stuttgart, 11J–124
utsu, Jinsuke, 11.10–213

aetzold, H. K., 11J–126, 11J–127, 11J–128, 11J–129, 11J–129, 11J–130, 11J–131, 11J–132
almer, C. E., 11.10–263
anchev, St., 11.10–330
anofsky, H. A., 11.10–283
apée, H. M., 11.10–354, 11.10–355
arczewski, W., 11.10–368
arker, M. J., 11.10–247
arkyn, D. G., 11J–60
aszyński, J., 11.10–17
earse, C. A., 11J–77
éczely, G., 11.10–258
édelaborde, P., 11.10–7
ekeris, C. L., 11.10–279
enn. State Univ. Ionosphere Res. Lab., 11.10–143
erl, M. L., 11.10–135
etri, Winfried, 11J–133, 11J–134, 11J–135
errin, R. M. S., 11.10–9
ettersson, H., 11.10–123
evtsov, G. A., 11.10–222
hillips, N. A., 11.10–272
isharoty, P. R., 11.10–260
lass, G. N., 11.10–318
odol'skiĭ, A. S., 11.10–380
okrzywnicki, J., 11.10–122
olovko, I. K., 11.10–5
ond, H. L., 11J–109
opov, V. S., 11.10–102
oppoff, I. G., 11.10–356
otter, J. G., 11.10–372
ravda, Moscow, 11J–136
riester, W., 11J–104, 11J–137, 11J–138
riestley, C. H. B., 11.10–284
rikhot'ko, G. F., 11.10–5
riroda, Moscow, 11.10–121
ristav, J., 11.10–335
rivett, D. W., 11.10–352
rokh, L. Z., 11.10–183
roskurin, V. F., 11.10–33
rosser, N. E., 11J–35
yle, R. L., 11.10–280

uiroz, R. S., 11.10–371

aff, S. J., 11.10–247
aĭzer, Iu. P., 11.10–126
aja Rao, K. S., 11.10–194
ama, ——, 11.10–58
amage, C. S., 11.10–296
amanathan, K. R., 11.10–268
ao, Y. P., 11.10–291
app, R. R., 11J–83
aspet, A., 11.10–25
atner, B., 11.10–343
Ray, E. C., 11.10–218
Reed, J. W., 11J–139
Reed, R. J., 11.10–287
Rees, M. H., 11.10–219
Reid, G. C., 11.10–219, 11J–13
Reiffel, L., 11.10–89
Reifferscheid, H., 11.10–339
Rein, F., 11.10–383
Repnev, A. I., 11J–30, 11J–107
Rex, D. F., 11.10–346
Rhodesia and Nyasaland Meteorological Service, 11.10–309
Riehl, H., 11.10–305
Roberts, W. O., 11.10–69, 11.10–320
Rogers, L. H., 11.10–259
Rogerson, J. B., Jr., 11.10–64
Ronne, C., 11.10–295
Rosen, M. W., 11.10–27
Rosenthal, S. L., 11.10–321, 11.10–322
Ross, Iu., 11.10–237
Rubin, Vera C., 11.10–94
Rudeĭko, V. A., 11.10–379
Rusin, N. P. (*ed.*), 11.10–10
Ruzecki, M. A., 11J–200

Safronov, V. S., 11.10–100
Sandford, B. P., 11.10–184
Sato, Teruo, 11.10–157
Sauberer, F., 11.10–377
Sauc er, W. J., 11.10–344
Schaeffer, O. A., 11.10–124
Schieldrup, P. H., 11.10–235
Schilling, G. F., 11J–140, 11J–141, 11J–142, 11J–164, 11J–165, 11J–195
Schindler, G., 11.10–96
Schlapp, D. M., 11.10–158
Schmeidler, F., 11.10–90
Schüepp, W., 11.10–307, 11.10–308
Schütze, G., 11.10–302
Schulze, R., 11.10–306
Science, Washington, 11J–143, 11J–144, 11J–145, 11J–146, 11J–147
Scorer, R. S., 11.10–285
Sedov, L. I., 11J–148
Sekera, Z., 11.10–2
Sekido, Y., 11.10–136
Seleshnikov, S. I., 11.10–62
Sellers, W. D., 11.10–351
Semonin, R. G., 11.10–358
Setterholm, V. M., 11J–185
Shaĭdman, V. A., 11.10–326
Sharp, G. W., 11.10–356
Shapiro, B. S., 11J–3
Shapiro, R., 11.10–327
Shapley, A. H., 11.10–18
Sharonov, V. V., 11.10–98
Shaw, J. E., 11.10–185
Shelby, J., 11.10–81
Sherman, F. S., 11.10–20
Shiotani, M., 11.10–336
Shteĭn, N. I., 11.10–242
Shternfel'd, A. A., 11J–149
Shvarts, Ia. M., 11.10–44
Shvidkovskiĭ, E. G., 11J–30
Sicinski, H. S., 11J–150
Silberstein, R., 11.10–159
Simons, D. G., 11.10–137
Sinclair, A. R., 11J–151
Singer, S. F., 11J–55, 11J–152, 11J–153, 11J–154, 11J–155, 11J–156, 11J–157, 11J–158
Singleton, F., 11.10–241
Sinha, K. L., 11.10–227
Sinton, W. M., 11.10–104
Siry, J. W., 11J–159
Skur d n, G. A., 11J–44
Slee, O. B., 11.10–82
Smiley, V. N., 11.10–239
Smith, A. G., 11.10–50
Smith, Frances H., 11.10–110
Smith, G. W., 11.10–310
Smith, J. A., 11.10–138
Smith, O. K., 11.10–39
Smith, R. H., 11.10–367
Snavely, B. L., 11.10–247
Sokolov, V. A., 11J–107
Sorodoc, C., 11.10–323
Soulage, G., 11.10–255, 11.10–373
Soviet writings on earth Satellites and space travel, 11J–28
Space Aeronautics Research and Development Hand Book, 11.10–26
Spencer, N. W., 11J–150
Spencer, N. W., 11J–150
Spitzer, L., Jr., 11.10–64, 11J–160
Sprague, G., 11.10–165
Squires, P., 11.10–359
Srinivasamurthy, B., 11.10–203
Srinivasan, T. R., 11.10–375
Standil, S., 11.10–139
Stanford Research Inst. Menlo Park, Cal f., 11.10–110, 11J–101
Starr, V. P., 11.10–273
Steinhäusser, H., 11.10–364
Steinhauser, F., 11.10–229
Sterne, T. E., 11J–140, 11J–141, 11J–161, 11J–162, 11J–163, 11J–164, 11J–165
Sternberg, S., 11J–166
Stevens, W., Jr., 11.10–245
Stewart, J. W., 11.10–93
Stewart, W. K., 11.10–56
Stokes, G. G., 11.10–2
Street, R. E., 11.10–20
Strocch , M. P., 11.10–83
Strong, J., 11.10–104, 11.10–232
Stroud, J. C., 11.10–48

Stroud, W. G., 11J–166, 11J–167, 11J–168
Struve, O., 11.10–66
Studia Geophysica et Geodaetica, Prague, 11.10–16, 11J–169
Stull, V. R., 11.10–318
Sutcliffe, R. C., 11.10–288

Taba, H., 11.10–345
Tamao, Tsutomu, 11.10–220
Tandberg-Hanssen, E., 11.10–78
Tchen, Chan-mou, 11.10–286
Thiruvenkatachar, V. R., 11J–170
Thompson, A. R., 11.10–179
Thompson, P. D., 11.10–248
Tick, L. J., 11.10–331
Touart, C. N., 11J–197
Tourin, R. H., 11.10–350
Townsend, J. W., Jr., 11J–119, 11J–171
Trenkle, H., 11.10–384
Třiska, P., 11.10–47
Troup, E. M., 11J–185
Tsuda, Takao, 11.10–160
Tsukamoto, Kenichi, 11.10–161
Twomey, S., 11.10–359, 11.10–360

Umschau Die, Frankfurt a.M., 11J–172
Ungstrup, E., 11.10–214
U. S. Air Weather Service. Climatic Center, 11J–173
U. S. Army Ballistic Missle Agency, 11.10–256
U. S. Dept. of the Army, 11J–174
U. S. National Aeronautics and Space Administration, 11J–175
U. S. Office of Naval Research, 11.10–20
U. S. Weather Bureau, 11.10–230, 11J–176
U. S. White Sands Signal Corps Agency, 11J–177
Unno, Wasaburo, 11.10–91
Urey, H. C., 11.10–99

Vachon, D. N., 11J–178
Vakhnin, V. M., 11.10–34
Van Allen, J. A., 11J–179, 11J–180, 11J–181
Van Der Kelen, G. P., 11.10–243
Vaughan, J. A., 11.10–381
Vaughan, W. W., 11.10–256
Vassy, E., 11J–182
Veldkamp, J., 11J–183
Verniani, F., 11.10–105, 11.10–106
Vestine, E. H., 11.10–186
Vickney, N., 11J–184
Viebrock, H., 11.10–269
Villard, O. G., Jr., 11.10–188
Villermaux, J., 11.10–244
Vincent, W. R., 11.10–110
Vitro Laboratories, 11J–185
von Braun, W., 11J–186
Votaw, M. J., 11J–37

Wackernagel, H. B., 11J–187
Wagner, N. K., 11.10–300
Waldmeier, M., 11.10–72, 11.10–73, 11.10–80
Wald, G., 11.10–68
Walden, H., 11.10–385
Walker, A. D. M., 11.10–148
Walker, D. M. C., 11J–89
Walker, (Mrs.) D. M. C., 11J–92, 11J–93
Wallace, L., 11.10–187
Walton, G. F., 11.10–270
Ward, W. H., 11.10–79
Warwick, C. S., 11.10–198
Watson, G. D., 11J–188
Watson, D. K., 11.10–81
Wegener, K., 11.10–311
Wegner, K. O., 11.10–337
Weiss, A. A., 11.10–114, 11.10–115, 11.10–116
Wentworth, R. E., 11J–158
Wexler, H., 11J–189, 11J–190, 11J–191, 11J–192
Wexler, R., 11J–193, 11J–194
White, M. L., 11.10–162
Whitney, C. A., 11J–142, 11J–196
Widger, W. K., Jr., 11J–2, 11J–197, 11J–198, 11J–199
Williams, D. T., 11.10–119
Wilson, R. H., Jr., 11.10–35
Winston, J. S., 11J–201
Wolczek, O. S., 11.10–28
Wood, M., 11.10–75
Wood, M. B., 11.10–198
Woodbury, M. A., 11.10–233
Wright, J. W., 11.10–163

Yeh, K. C., 11.10–188
Yoshida. S., 11.10–136
Young, J. W., 11.10–42

Zander, W., 11.10–192
Zebergs, V., 11.10–66
Zelikoff, M. (*ed.*), 11.10–103
Zirin, H., 11.10–69, 11.10–78
Zschörner, H., 11J–28, 11J–130
Zutshi, P. K., 11.10–58

INDEX OF SUBJECTS

Ångström pyrheliometer, 11.10–237
Absorption by clouds, 11.10–317
Acoustics, 11.10–367
Adsorption of water vapor on sodium chloride, 11.10–354, 11.10–355
Advection fog, 11.10–363
Advection of heat, 11.10–333, 11.10–360
Aerodynamic effects, 11J–148
Aerological instruments, 11.10–10
Aeronautical dictionaries, 11.10–12
Aeronomy, 11.10–262
Air density, 11J–104, 11J–122, 11J–128
Air density calculations, 11J–164, 11J–165
Air density data, 11.10–256
Air density effects on satellites, 11.10–37, 11J–75
Air density variations, 11J–138
Air masses, 11.10–304
ARDC model atmosphere, 11J–109
Airglow spectrum theories, 11.10–187
Albedo data, 11.10–17, 11J–168
Albedo measurement with satellite, 11J–153
Albedo measurements, 11J–52
Albedo of earth's atmosphere, 11.10–315
Albedo of vegetation, 11.10–312
Altitude effects on temperature, 11.10–253
Annual albedo variations, 11.10–313
Anti-multipath equpiment, 11.10–159
Arch effects on wind and temperature, 11.10–379
Arctic circulation, 11.10–287, 11.10–290
Arctic stratosphere, 11.10–290
Arctic stratospheric temperatures, 11.10–19
Artificial fog dissipation, 11.10–362
Astroballistic erosion, 11.10–117, 11.10–119
Astronautics, 11.10–38, 11J–28

Astronomical instruments, 11.10–62
Astronomcial meteorology, 11.10–61
Astronomy yearbooks, 11.10–61
Astrophysical laboratories, 11.10–28
Atmospheric circulation, 11J–100
Atmospheric circulation disturbances, 11.10–290
Atmospheric circulation experiments, 11.10–6
Atmospheric density models, 11J–75
Atmospheric disturbance tracking from satellites, 11J–34
Atmospheric disturbances, 11.10–275
Atmospheric drag, 11J–60
Atmospheric electricity, 11.10–61
Atmospheric extinction, 11.10–17
Atmospheric models, 11J–140, 11J–163, 11J–164, 11J–196
Atmospheric motion, 11.10–278
Atmospheric nuclei, 11.10–358
Atmospheric optics, 11J–33
Atmospheric oscillations, 11.10–162, 11.10–328
Atmospheric pollution, 11.10–120, 11.10–258, 11.10–259
Atmospheric radiation, 11J–99
Atmospheric radiation upward flux, 11.10–315
Atmospheric tides, 11.10–279
Atmosperhic transmission, 11.10–316, 11.10–318
Atmospheric turbulence, 11.10–276
Atmospheric turbulence energy, 11.10–25
Atmospheric wave structure, 11.10–325
Atmospheric windows, 11.10–88
Atom bomb tests, 11.10–59
Aurora australis, 11.10–184
Aurora borealis, 11.10–182, 11.10–183
Auroral descriptions, 11.10–176
Auroral effects on radio propagation, 11.10–188
Auroral emissions, 11.10–167, 11.10–168, 11.10–177, 11.10–180, 11.10–181
Auroral forms, 11.10–166
Auroral frequencies, 11.10–175
Auroral-geomagnetic relationships, 11.10–178, 11.10–197
Auroral ionization, 11.10–182
Auroral ionization of E layer, 11.10–154, 11.10–185
Auroral latitude, 11.10–166
Auroral luminosity curves, 11.10–164
Auroral-magnetic relationships, 11.10–171, 11.10–174, 11.10–175, 11.10–185, 11.10–199
Auroral nitrogen bands, 11.10–173, 11.10–177
Auroral photographs, 11.10–169
Auroral photography, 11.10–184
Auroral spectra, 11.10–165, 11.10–172
Auroral temperatures, 11.10–173, 11.10–180, 11.10–181, 11.10–187
Auroral zones, 11.10–175, 11.10–197, 11.10–217
Auroras, 11.10–186, 11.10–219
Autocorrelations, 11.10–292
Automation in meteorology, 11J–36
Aviation medicine, 11.10–56

Ballistic meteorology textbooks, 11J–32
Balloon ascension rates, 11.10–227
Balloon radiation observations, 11.10–232
Baroclinic disturbances, 11.10–248
Baroclinic waves, 11.10–278
Barotropic models, 11.10–249
Barotropic vorticity equations, 11.10–272
Bering-Chukchi land bridge, 11.10–378
Bibliography on radio observation of meteors, 11.10–110
Bioclimatology, 11.10–382
Biological effects of cosmic rays, 11.10–137
Biological effects of weather elements, 11.10–339
"Black Ball," 11.10–226, 11.10–238
Blackbody radiation, 11.10–238, 11.10–311
Booker's theory of meteoric reflection, 11.10–112
Bora, 11.10–334
Boundary layer theory, 11.10–271

Carbon dioxide spectrum, 11.10–350
Chilling, 11.10–381
Clear air turbulence, 11.10–23
Climate of Estonia, 11.10–376
Climate of Falkland Islands, 11.10–231
Climate of Paris Basin, 11.10–7
Climate of Sahara, 11.10–8
Climate of Ukraine, 11.10–5
Climatic data, 11.10–8
Clothing climate, 11.10–381
Cloud cover, 11J–105
Cloud droplet formation, 11.10–361
Cloud formations, 11J–101
Cloud movement, 11J–100
Cloud nuclei, 11.10–359, 11.10–360
Cloud observations, 11J–47
Cloud photographs, 11.10–295
Cloud photography, 11J–2, 11J–43, 11J–57, 11J–147, 11J–166, 11J–178, 11J–200, 11J–201
Cloud physics research, 11.10–358
Cloud seeding effectiveness, 11.10–255
Cloud seeding for up-draft production, 11.10–25
Cloud systems, 11J–192
Cloud types, 11.10–370
Cloud velocity, 11J–2
Cold vortexes, 11.10–263
Color photography, 11.10–184
Condensation nuclei, 11.10–361
"Continental effect" on ionospheric electron density, 11.10–145
Convection, 11.10–273
Convective cloud structure, 11.10–359
Convergence and divergence, 11.10–281
Coronal emission lines, 11.10–80, 11.10–87
Coronal radio wave reflection, 11.10–97
Corpuscular emissions from sun, 11.10–85, 11.10–95
Corpuscular radiation, 11.10–319, 11.10–320
Cosmic dust origin, 11.10–126
Cosmic electrodynamic textbooks, 11.10–3
Cosmic nuclear energy, 11.10–28
Cosmic radiation, 11J–136
Cosmic ray decreases, 11.10–134
Cosmic ray effects on meteorites, 11.10–124, 11.10–125, 11.10–133
Cosmic ray instruments, 11.10–132, 11.10–139
Cosmic ray intensities, 11.10–127, 11.10–128, 11.10–130
Cosmic ray mesons, 11.10–138

Cosmic ray origin, 11.10–136
Cosmic ray photographs, 11.10–135
Cosmic ray research, 11.10–131
Cosmic ray storms, 11.10–178
Cosmic ray variations, 11.10–129
Cosmic ray variations at sea level, 11.10–138
Cosmogony, 11.10–100
Cut-off cyclones, 11J–201
Czechoslovak participation in IGY, 11.10–16, 11J–169

D region, 11.10–324
Deacon wind profile, 11.10–336
Density gradient in upper atmosphere, 11J–76
Dew point, 11.10–351
Diffusion of particles, 11.10–286
Dissociation and recombination of oxygen and nitrogen molecules, 11J–122
Diurnal pressure oscillations, 11.10–280
Diurnal pressure variations, 11.10–274
Diurnal temperature variations, 11.10–322
Diurnal variations, 11J–104
Doppler displacement in solar spectrum, 11.10–91
Doppler displacement of auroral hydrogen lines, 11.10–164
Doppler effects, 11J–137
Doppler-Fizeau effects, 11J–182
Drop formation, 11.10–353
Droplet coagulation, 11.10–241
Dry periods, 11.10–364
Dust content of the upper atmosphere, 11.10–257
Dust devils, 11.10–297
Dust meters, 11.10–257
Dust storms, 11.10–298
Dwelling microclimatology, 11.10–379
Dynamic climatology, 11.10–383
Dynamo theory of ionosphere, 11.10–162

E layer ionization, 11.10–140
Earth satellite symposia, 11J–146
Earth's atmosphere, 11J–24
Earth's oblateness, 11J–134
Eclipse effects on ionospheric layers, 11.10–148
Electromagnetic radiation, 11.10–31
Electron collision frequencies, 11.10–158
Electron concentration of outer ionosphere, 11J–3
Electron density, 11J–134
Electron density in F 2 layer, 11.10–150
Electron density in F 2 region, 11.10–145, 11.10–149
Electron density in sun's corona, 11.10–81, 11.10–82,
Electronic computer uses, 11.10–191
Electronic equipment, 11J–21
Electrostatic fluxmeters, 11.10–44
Energy balance, 11.10–276
Energy balance of earth, 11.10–306
Energy exchange river-atmosphere, 11.10–337
Equatorial circulation, 11.10–346
Equivalent barotropic level, 11.10–345
Evaporation data, 11.10–352
Evaporation over Indian Ocean, 11.10–352
Excitation mechanisms, 11.10–182
Exosphere, 11.10–101, 11J–19, 11J–109, 11J–128, 11J–157
Exospheric emissions, 11.10–221

F layer, 11.10–158, 11J–132
*fo*F2 disturbances, 11.10–157
Faraday effects, 11J–182
Fellgett's technique, 11.10–63
Fire weather studies, 11.10–333
Flow charts, 11J–199
Föhn weather, 11.10–339
Fog dissipation, 11.10–255
Fog particle investigation, 11.10–362
Fog precipitation, 11.10–255
Fog seeding, 11.10–255
Forbidden [OI] lines, 11.10–180, 11.10–181
Forecast improvement, 11.10–254
Forecasting for jet aircraft, 11.10–288
Freezing nuclei, 11.10–356
Freezing nuclei content of atmospheric aerosols, 11.10–373
Frontal circulation, 11.10–289
Frontal perturbations, 11.10–305
Frontal theories, 11.10–303
Full moon data, 11.10–96

Gas pressure measurement, 11.10–4
Geiger counters, 11.10–243
Geomagnetic activity, 11.10–171
Geomagnetic correlation with pressure, 11.10–327
Geomagnetic disturbance centers, 11.10–195
Geomagnetic disturbances, 11.10–196, 11.10–198
Geomagnetic effects on cosmic rays, 11.10–130, 11.10–134
Geomagnetic effects on ionization, 11.10–154
Geomagnetic field, 11.10–190, 11.10–191
Geomagnetic field components, 11.10–35
Geomagnetic field intensities, 11.10–194, 11.10–206
Geomagnetic field measurement, 11.10–189
Geomagnetic fluctuation coincidence ratios, 11.10–205
Geomagnetic fluctuations, 11.10–199
Geomagnetic instruments, 11.10–189
Geomagnetic micropulsations, 11.10–204
Geomagnetic storms, 11.10–201, 11.10–202
Geomagnetic-upper wind relationships, 11.10–342
Geophysical research, 11J–29
Giant nuclei, 11.10–373
Glacier-meteorological observations, 11.10–298
Glass filters, 11.10–236
Gliding meteorology, 11.10–24
Green flash, 11.10–385, 11.10–386

Hail damage, 11.10–374
Hail formation, 11.10–373
Hail frequency distribution, 11.10–374
Hail prevention, 11.10–373
Hailstorms, 11.10–373
Harmonic analysis, 11.10–190
Heat balance of earth, 11.10–1
Heat exchange sea-atmosphere, 11.10–277
Heat flux, 11.10–284
Heat sources and sinks, 11.10–274
Heat transport, 11.10–277
Hemispheric forecasts, 11.10–249, 11.10–252
High altitude balloon ascents, 11.10–217
High altitude temperatures, 11J–172
Highways, 11.10–54
Historic weather records, 11.10–22

History of forecasting, 11.10–254
Hot humid climate photography, 11.10–55
Human climatology, 11.10–381
Humid tropics research, 11.10–382
Hurricane clouds, 11.10–295
Hurricane "Daisy" (1958), 11.10–295
Hurricane development, 11.10–296
Hurricane development areas, 11.10–296
Hurricane dynamics, 11.10–294
Hurricane frequencies, 11.10–296
Hurricane models, 11.10–294
Hurricane research projects, 11J–176
Hydrogen lines, 11.10–165
Hydrostatic equilibrium, 11.10–273

Ice crystal formation, 11.10–353
Ice crystal nuclei, 11.10–357
Ice nuclei counters, 11.10–357
Ice surveys, 11.10–231
Infrared absorption, 11.10–318
Infrared absorption spectrum, 11.10–350
Infrared radiation, 11J–69
Infrared radiation detectors, 11.10–234
Infrared radiation filters, 11.10–239
Infrared radiation measurement techniques, 11J–194
Infrared radiation measurements, 11.10–234, 11J–58
Infrared radiation studies, 11.10–314
Infrared spectra, 11.10–232
Infrared transmission through haze, 11.10–316
Instrument manuals, 11.10–10
Interdiurnal temperature variations, 11.10–321
Interference filters, 11.10–239
Interferometers, 11.10–63
Interhemispheric circulation relationships, 11.10–291
International astronautical congresses, 11J–186
International Geophysical Year, 1957–1958, 11.10–15, 11.10–134, 11J–122
IGY aurora program, 11.10–174
IGY conferences, 11J–119
IGY cosmic radiation program, 11.10–128, 11.10–129
IGY data control, 11.10–18
IGY history, 11.10–15
IGY program, 11.10–13, 11.10–14, 11J–6, 11J–106, 11J–169
IGY research, 11J–79
IGY rocket program, 11.10–118
IGY Rocket Report, 11J–5
IGY satellite program, 11.10–11, 11J–9, 11J–25, 11J–47, 11J–64, 11J–73, 11J–85, 11J–116 to 11J–118, 11J–156
IGY Satellite Report, 11J–5
IGY upper air data, 11.10–230
IGY whistler program, 11.10–207, 11.10–208
Interplanetary space, 11.10–202
Interplanetary trajectories, 11.10–39
Ion-atom interchange, 11.10–261
Ion density, 11.10–206
Ionization, 11J–122
Ionization height variations, 11.10–140
Ionized hydrogen in outer atmosphere, 11.10–213
Ionospheric heating, 11.10–269
Ionospheric absorption calculation, 11.10–147
Ionospheric absorption measurement techniques, 11.10–147
Ionospheric anomalies, 11.10–154
Ionospheric coupling, 11.10–146
Ionospheric cross modulation, 11.10–153
Ionospheric disturbances, 11.10–186
Ionospheric drift measurements, 11.10–161
Ionospheric dynamics, 11.10–162
Ionospheric electron density, 11.10–116, 11.10–150
Ionospheric electron density computation, 11.10–149
Ionospheric electron density distribution, 11.10–160, 11.10–319
Ionospheric electron density variations, 11.10–163
Ionospheric ionization, 11J–129
Ionospheric measuring equipment, 11.10–143
Ionospheric movements, 11.10–160
Ionospheric radio wave propagation, 11.10–144, 11.10–151, 11.10–159
Ionospheric radio wave refraction, 11J–129
Ionospheric radio wave refraction coefficients, 11.10–151, 11.10–155
Ionospheric storms, 11.10–178
Ionospheric temperatures, 11.10–324
Ionospheric tilt, 11.10–188
Ionospheric variations, 11.10–142, 11.10–150, 11.10–152
Ionospheric winds in Polar regions, 11.10–342
Iron, 11.10–120
Isotropic turbulence, 11.10–331

Jet stream climatology of U. S., 11.10–343
Jet stream-frontal relationships, 11.10–289, 11.10–303
Jet stream variations, 11.10–288
Jet stream winds, 11.10–344, 11.10–345
Joint Numerical Weather Prediction Project, 11.10–249

K-index, 11.10–171

Large scale weather processes, 11.10–248
Lee waves, 11.10–24, 11.10–347, 11.10–348
Life on Mars, 11.10–102
Life on planets, 11.10–101
Lightning discharges, 11.10–388
Lightning flash duration, 11.10–387
Lightning forms, 11.10–387
Lightning frequencies, 11.10–368
Lightning pre-discharges, 11.10–388
Lightning strokes, 11.10–388
Log-normal rainfall distribution, 11.10–366
Long wave radio disturbances, 11.10–47
Long waves, 11.10–325, 11.10–349
Low level wind measurement techniques, 11.10–332
Lunar cycles, 11.10–96
Lunar diurnal magnetic variations, 11.10–194
Lunar effects, 11.10–96
Lunar magnetic field, 11.10–95, 11J–96
Lunar theories, 11.10–99
Lyman alpha radiation measurements, 11J–26

Magnetic current systems, 11.10–195, 11.10–196
Magnetic disturbances, 11.10–192, 11.10–193
Magnetic effects on cosmic rays, 11.10–218

Magnetic effects on ionosphere, 11.10–157, 11.10–161
Magnetic effects on radio propagation, 11.10–51
Magnetic pulsations, 11.10–200
Magnetic storms and auroras, 11.10–178, 11.10–186
Magnetohydrodynamics, 11.10–3, 11.10–220
Magnetometers, 11.10–95, 11.10–189
Martian atmosphere, 11.10–102
Maximum probable precipitation estimates, 11.10–366
Maximum temperature forecasting, 11.10–253
Mean wind flow patterns, 11.10–346
Mediterranean circulation, 11.10–288
Meriodional circulation, 11.10–268
Meridional wind components, 11.10–291
Meteor communications, 11.10–113
Meteor deceleration, 11.10–105, 11.10–106
Meteor echo duration, 11.10–113
Meteor echo measurement techniques, 11.10–109
Meteor echo soundings, 11.10–112
Meteor echoes, 11.10–114
Meteor radiant distribution, 11.10–111
Meteor spectra, 11.10–107
Meteoric dust collectors, 11.10–244
Meteoric dust falls, 11.10–120
Meteoric dust hypothesis, 11.10–244
Meteorite frequencies, 11.10–123
Meteorite pitting, 11.10–119
Meteorites, 11.10–122, 11.10–126
Meteoritic helium, 11.10–124, 11.10–125, 11.10–133
Meteorological instruments, 11.10–10
Meteorological observations, 11.10–231
Meteorological satellites, 11J–12, 11J–43, 11J–49, 11J–51, 11J–54, 11J–56, 11J–58, 11J–110, 11J–166, 11J–167, 11J–190 to 11J–192, 11J–199, 11J–200, 11J–201
Meteors, 11.10–108
Microcalorimetry, 11.10–355
Micromanometers, 11.10–4
Micrometeorites, 11.10–118, 11J–134
Micrometeorology conferences, 11.10–1
Micrometeorology studies of U.S.S.R., 11.10–1
Missile Geophysics Program, 11J–177
Model experiments, 11.10–379
Moon, 11.10–98
Mountain observations, 11.10–380
Mountain waves, 11.10–347, to 11.10–349
Multiple lightning strokes, 11.10–387

NASA, 11J–171
NASA dictionary, 11.10–12
NASA space science program, 11J 72, 11J–175
n-body problem, 11.10–38, 11.10–39
Nebulae, 11.10–67
Neutral air particle collisions, 11J–77
New serial publications, 11.10–11
Night sky brightness, 11.10–228
Nitric oxide, 11.10–259
Nitrogen dissociation, 11.10–261
Nitrogen oxides in atmosphere, 11.10–259
Nuclear experiments in space, 11.10–28
Nuclear explosion effects on geomagnetism, 11.10–193
Nucleation of supercooled water, 11.10–356
Nucleation processes, 11.10–354, 11.10–355
Nuclei-droplet relationships, 11.10–359
Nuclei sources, 11.10–360
Numerical analysis smoothing techniques, 11.10–272
Numerical forecasting, 11.10–251, 11.10–252
Numerical forecasting with primitive equations, 11.10–250
Numerical models including topographic effects, 11.10–249

Ocean current dynamics, 11.10–341
Optical refraction, 11.10–61
Orbital elements, 11J–38
Origin of whistlers, 11.10–210
Orographic effects on winds, 11.10–335
Orographic turbulence, 11.10–280
Outer atmosphere, 11.10–202, 11.10–215, 11.10–216, 11.10–220
Outer atmosphere investigations, 11J–65
Outer atmosphere structure, 11J–131
Oxygen bands, 11.10–187
Ozone absorption, 11.10–266
Ozone conferences, 11.10–21
Ozone distribution in upper atmosphere, 11.10–265, 11J–193
Ozone variations, 11.10–267
Ozonesonde comparisons, 11.10–245, 11.10–246

Persistence, 11.10–292, 11.10–364, 11.10–375
Perturbation equations, 11.10–33
Photobiological effects, 11.10–68
Photoelectric cells, 11.10–234
Photoelectric spectrophotometers, 11.10–64
Photochemistry of upper atmosphere, 11.10–262
Photographic equipment protection in hot humid climates, 11.10–55
Photographic observations, 11J–12
Photolytic decomposition of ozone, 11.10–266
Photometers, 11J–88
Photomicrographs, 11.10–370
Physiological effects on satellite passengers, 11J–172
Planetary atmospheres, 11.10–103, 11J–79
Planetary circulation, 11.10–278
Planetary climates, 11.10–101
Planetary influences, 11.10–293
Planetary origin symposia, 11.10–100
Planetary temperatures, 11.10–104
Planetary vegetation, 11.10–102
Planetoid orbits, 11.10–65
Pleistocene climates of Bering Strait, 11.10–378
Polar blackouts, 11.10–188
Polar magnetic storms, 11.10–157
Polarization of sky radiation, 11.10–315
Polish Expedition to Vietnam, IGY 1957/1958, 11.10–17

Polish participation in IGY, 11.10–174
Precipitation forecasting, 11.10–241
Precipitation intensity-lightning discharge correlations, 11.10–368
Precipitation physics, 11.10–358
Precipitation probabilities, 11.10–365
Pressure distribution, 11.10–327
Pressure-temperature correlations, 11.10–330
Pressure-wind relationships, 11.10–326
Progress in meteorology, 11J–36
Progress in solar physics, 11.10–69
Project Jet Stream, 11.10–344
Project MOUSE, 11J–152
Project Vanguard, 11.10–27, 11J–10, 11J–23, 11J–24, 11J–37, 11J–44, 11J–64, 11J–65, 11J–116
Pyrheliometric scales, 11.10–224

Radar meteorology, 11J–32
Radar observation of whistlers, 11.10–209
Radar precipitation studies, 11J–101
Radar rainfall measurement, 11J–110
Radarsondes, 11J–110
Radiation balance meters, 11.10–235
Radiation budget, 11.10–306
Radiation charts, 11.10–226
Radiation climatology, 11.10–377
Radiation data, 11.10–61
Radiation equilibrium of MOUSE, 11J–55
Radiation from planetary atmospheres, 11.10–2
Radiation measurement comparisons, 11.10–224
Radiation measurement techniques, 11.10–226
Radiation measurements, 11J–13, 11J–105
Radiation research, 11J–187
Radiation tables, 11.10–2
Radiational temperature, 11.10–226, 11.10–238
Radio echoes from meteors, 11.10–114, 11.10–116
Radio echoes from weak meteor showers, 11.10–115
Radio emissions from exosphere, 11.10–221
Radio fading, 11.10–75
Radio field strength during solar eruptions, 11.10–47
Radio interferometer techniques, 11J–182
Radio meteor trail observation techniques, 11.10–110
Radio meteorology, 11.10–46
Radio noise, 11.10–50
Radio noise from auroras, 11.10–167, 11.10–168
Radio noise from ionosphere, 11.10–324
Radio observation techniques, 11J–137, 11J–138
Radio satellite observation, 11.10–41
Radio star occultation, 11.10–81, 11.10–82
Radio transmissions, 11J–182
Radio wave polarization, 11.10–143, 11.10–144, 11.10–156
Radio wave propagation beyond the horizon, 11.10–48, 11.10–49
Radio wave propagation theories, 11.10–51
Radio wave reflection from auroras, 11.10–170
Radio wave reflection from meteors, 11.10–111
Radio wave reflection from moon, 11.10–97
Radio wave scattering by meteors, 11.10–113
Radioactive diffusion, 11.10–60
Radioactive fallout data, 11.10–58, 11.10–59
Radioactive rainwater, 11.10–58
Radioactivity in the atmosphere measurement techniques, 11.10–257
Radioactivity in the upper atmosphere, 11.10–257
Radioactivity measurements, 11J–105
Radiometry, 11.10–104
Radiosonde development, 11.10–247
Radiosonde transmitters, 11.10–242
Radiosondes, 11J–32
Raindrop observation in clouds, 11.10–241
Rainfall effects on underwater noise, 11.10–367
Rainy spells, 11.10–364
Rayleigh scattering tables, 11.10–2
Record snowfall, Tucson, Ariz. (Nov. 1958), 11.10–370
Red auroral lines, 11.10–172
Red sunspots, 11.10–72
Refractive index, 11.10–155
Relative humidity distribution, 11.10–351
Relative humidity variations, 11.10–381
Research programs, 11J–171
Ring currents, 11.10–215
Rocket and satellite data availability, 11J–173
Rocket bibliographies, 11J–174
Rocket data, 11J–80
Rocket development, 11J–24
Rocket instrumentation, 11J–123
Rocket meteorite observations, 11.10–118
Rocket observation of the upper atmosphere, 11J–73
Rocket observations, 11J–45
Rocket propulsion, 11.10–29, 11.10–30
Rocket radiation measurements, 11.10–43
Rocket research, 11.10–57, 11J–15, 11J–44
Rocket trajectories, 11.10–233
Rockets, 11J–20
Rossby's vorticity theory, 11.10–278
Rotating cylinder experiments, 11.10–6
Rotating cylinder experiments, 11.10–6

S_q wind systems, 11.10–342
Sailplane observations, 11.10–325
Satellite acceleration, 11J–74 to 11J–76
Satellite air density measurement techniques, 11J–81, 11J–142
Satellite albedo measurements, 11J–156, 11J–168
Satellite bibliographies, 11J–174
Satellite data, 11J–7, 11J–39, 11J–140, 11J–157, 11J–196, 11J–197, 11J–199
Satellite density measurements, 11J–1, 11J–59, 11J–61 to 11J–63, 11J–66, 11J–89, 11J–90, 11J–91, 11J–93, 11J–94, 11J–141, 11J–150, 11J–160, 11J–161
Satellite density observations, 11J–98, 11J–130
Satellite design, 11J–54, 11J–124
Satellite development, 11J–36
Satellite drag, 11J–77, 11J–81

Satellite ground systems, 11J–86
Satellite instrumentation, 11.10–44, 11.10–52, 11J–12, 11J–16, 11J–21, 11J–27, 11J–31, 11J–51, 11J–53, 11J–82, 11J–95, 11J–111, 11J–114, 11J–123, 11J–147, 11J–155, 11J–156, 11J–181, 11J–185
Satellite ionospheric observations, 11J–3
Satellite laboratories, 11J–126
Satellite launching vehicles, 11.10–27
Satellite manometers, 11J–97
Satellite meteorology, 11J–198
Satellite motion, 11.10–36
Satellite observation of infrared, 11J–194
Satellite observation of upper atmosphere, 11J–73, 11J–129, 11J–132
Satellite observation techniques, 11J–47
Satellite observational data, 11J–127, 11J–133
Satellite observations, 11.10–34, 11J–2, 11J–29, 11J–42, 11J–45, 11J–64, 11J–68, 11J–105, 11J–121, 11J–122, 11J–128, 11J–131, 11J–135, 11J–136, 11J–164, 11J–165, 11J–172
Satellite observatories, 11J–4, 11J–11, 11J–17, 11J–22, 11J–23, 11J–25, 11J–32, 11J–34, 11J–40, 11J–41, 11J–65, 11J–67, 11J–70, 11J–84, 11J–106, 11J–111, 11J–114, 11J–118, 11J–149, 11J–153, 11J–155, 11J–170, 11J–183, 11J–187, 11J–189, 11J–190
Satellite observatory conferences, 11J–179
Satellite observatory programs, 11J–180
Satellite optical absorption techniques, 11J–33
Satellite orbits, 11.10–33, 11.10–37, 11J–19, 11J–60, 11J–67, 11J–138, 11J–148, 11J–152, 11J–155, 11J–159, 11J–162, 11J–195
Satellite ozone observation, 11J–158
Satellite photography, 11J–101, 11J–167
Satellite pressure measurement, 11J–150
Satellite programs, 11J–31, 11J–52
Satellite radiation equipment, 11J–26
Satellite radiation measurements, 11J–69, 11J–99
Satellite radiation observations, 11.10–45, 11J–78
Satellite re-entry, 11.10–32, 11.10–42
Satellite reflectivity, 11J–151
Satellite research, 11J–15, 11J–44, 11J–143, 11J–181
Satellite spin, 11.10–35
Satellite sunlight reflection, 11.10–45
Satellite television observation techniques, 11J–50, 11J–102
Satellite temperature calculations, 11J–48, 11J–55
Satellite temperature observations, 11J–88
Satellite temperatures, 11J–48
Satellite tracking, 11.10–40, 11.10–41, 11J–8, 11J–79
Satellite uses, 11J–49, 11J–57, 11J–83, 11J–84, 11J–87, 11J–100, 11J–103, 11J–108, 11J–113, 11J–125, 11J–146, 11J–154, 11J–176, 11J–178, 11J–179, 11J–193, 11J–198
Satellite uses in meteorology, 11J–52
Satellite uses in weather forecasting, 11J–35
Satellite visibility, 11J–1
Satellite weather reconnaissance, 11J–56, 11J–57
Satellites, 11J–20, 11J–30, 11J–144
Sea breeze-bora relationships, 11.10–334
Sea breeze circulation, 11.10–333
Sea breezes, 11.10–332
Sea surface topography, 11.10–341
Seasonal magnetic variations, 11.10–196
Semidiurnal atmospheric oscillations, 11.10–279
Serial publications, 11J–5
Series analysis, 11.10–375
700 mb Northern Hemisphere mean 5-day charts, 11.10–292
Shear stress, 11.10–276, 11.10–284
Short wave radiation, 11.10–317
Silver iodide nucleation, 11.10–356
Sky brightness measurements, 11.10–228
Skylight polarization, 11.10–2
Slope microclimatology, 11.10–380
Smoke plume behavior, 11.10–285
Snow accumulation, 11.10–372
Snow cover data, 11.10–54
Snow cover depth, 11.10–372
Snow cover duration, 11.10–372
Snow crystal forms, 11.10–370
Snowfall above freezing temperature, 11.10–369
Snowfall extremes, 11.10–371
Snowfall-visibility relationships, 11.10–287
Soaring, 11.10–25
Soil classification, 11.10–9
Solar activity, 11J–78
Solar batteries, 11.10–52, 11.10–53
Solar collectors, 11.10–307, 11.10–308
Solar constant, 11.10–311
Solar corpuscular radiation, 11.10–202
Solar eclipse effects on ionosphere, 11.10–142
Solar eclipse, Feb. 1952, 11.10–94
Solar eclipses, 11.10–93
Solar effects on auroras, 11.10–179
Solar effects on general circulation, 11.10–263, 11.10–320
Solar effects on upper atmosphere density, 11J–74, 11J–89, 11J–92, 11J–93
Solar energy availability, 11.10–307
Solar energy utilization, 11.10–308
Solar eruption effects on radio communication, 11.10–47
Solar filaments, 11.10–83
Solar flare data, 11.10–73
Solar flare effects on geomagnetism, 11.10–76
Solar flare emissions, 11.10–77, 11.10–79
Solar flares, 11.10–76
Solar flocculi, 11.10–85
Solar flocculi data, 11.10–83, 11.10–84
Solar-geomagnetic relationships, 11.10–85, 11.10–89
Solar-ionospheric relationships, 11.10–152
Solar limb darkening, 11.10–94
Solar-magnetic relationships, 11.10–179, 11.10–198, 11.10–199, 11.10–201
Solar photography, 11.10–92
Solar physics, 11.10–69
Solar prominence spectra, 11.10–78
Solar prominences, 11.10–86
Solar radiation data, 11.10–309, 11.10–310

Solar radiation intensities, 11.10–315
Solar radiation measurement techniques, 11.10–237
Solar radiation measurement, 11.10–17, 11J–27, 11J–104
Solar radiation on clear days, 11.10–314
Solar-radio communication relationships, 11.10–75
Solar radio emissions, 11.10–201
Solar radio noise bursts, 11.10–77, 11.10–179, 11.10–198
Solar spectroscopy, 11.10–88
Solar-terrestrial relationships, 11J–153
Solar turbulence, 11.10–90, 11.10–91
Solar-weather relationships, 11.10–384
Solar wind, 11.10–74
Soviet cosmic rockets, 11J–96
Soviet participation in IGY, 11J–119
Soviet rockets, 11J–44
Soviet satellite, 1957 Alpha (Sputnik I), 11J–3, 11J–42, 11J–126, 11J–133, 11J–138, 11J–139, 11J–163, 11J–195
Soviet satellite, 1957 Beta (Sputnik II), 11J–60, 11J–114, 11J–126, 11J–133, 11J–195
Soviet satellite, 1958 Delta (Sputnik III), 11J–13, 11J–18, 11J–27, 11J–39, 11J–60, 11J–82, 11J–95, 11J–107, 11J–130
Soviet satellites, 11.10–11, 11.10–41, 11J–8, 11J–28, 11J–38, 11J–89, 11J–92, 11J–94, 11J–96, 11J–98, 11J–125, 11J–127, 11J–131, 11J–134, 11J–136, 11J–143, 11J–148, 11J–172
Space aeronautics handbook, 11.10–26
Space communication, 11.10–50
Space flight physiology, 11.10–57
Space flight research, 11J–145
Space flight textbooks, 11J–14
Space flights, 11.10–31, 11.10–32 11J–171
Space medicine, 11.10–56, 11.10–57
Space programs, 11J–144
Space research, 11J–20, 11J–120, 11J–188
Space Science Board, 11J–145
Space vehicles, 11J–120
Spectral radiation, 11.10–68
Spectrometers, 11.10–139
Spectrophotometric meteor studies, 11.10–107
Sporadic E layer (Es), 11.10–144
Spread F variations, 11.10–141
Stability change forecasting, 11.10–251
Stack effluent diffusion, 11.10–284
Standard atmosphere, 11J–161
Standard atmosphere for tropics, 11.10–260
Standard isobaric surfaces, 11.10–260
Statistical theory of turbulence, 11.10–329
Stellar spectra, 11.10–64, 11.10–66
Stellar spectrometers, 11.10–63
Stokes' law, 11.10–361
Storm detection, 11J–154
Storm rainfall frequency relations, 11.10–365
Stratified fluid flow, 11.10–271
Stratospheric Polar vortexes, 11.10–263
Stratospheric temperature measurement techniques, 11J–88
Strong wind frequencies, 11.10–343
Sudden commencements, 11.10–203 to 11.10–205
Sunlit auroral spectra, 11.10–173
Sun's corona, 11.10–74, 11.10–81, 11.10–82, 11.10–86, 11.10–87
Sunrise effects on ionosphere, 11.10–142
Sunshine data, 11.10–229
Sunshine duration, 11.10–229
Sunshine duration data, 11.10–309, 11.10–310
Sunshine variations, 11.10–229
Sunspot data, 11.10–71
Sunspot effects on cosmic rays, 11.10–134
Sunspot effects on ionosphere, 11.10–150
Sunspot-solar flare relationships, 11.10–73
Sunspot umbrae, 11.10–70, 11.10–72
Supersaturation, 11.10–353
Surface pressures, 11.10–327
Surface roughness effects on wind, 11.10–282
Synchrometers, 11J–150
Synoptic climatology of Paris Basin, 11.10–7
Synoptic cloud observations, 11J–49
Synoptic conditions for thunderstorms, 11.10–301
Synoptic types in France, 11.10–7

Telluric currents, 11.10–200
Temperature correlations, 11.10–323
Temperature inversions, 11.10–323, 11.10–325
Temperature over oceans, 11.10–281, 11.10–321, 11.10–322
10 mb synoptic charts, 11.10–320
Thermal chemical dissociation, 11.10–240
Thermal convection in sun, 11.10–90
Thermals, 11.10–24, 11.10–25
Thermodynamics of the stmosphere, 11.10–281, 11.10–328
Thermoelectric actinometers, 11.10–237
Thermosphere, 11.10–262, 11J–15, 11J–121
Three-body problem, 11.10–65
Thunderstorm activity, 11.10–301
Thunderstorm rainfall intensities, 11.10–368
Thunderstorms, 11.10–302
Tornado, Austin, Texas (May 10, 1959), 11.10–300
Tornado analysis, 11.10–300
Tornado damage, 11.10–302
Tornado frequencies, 11.10–299
Tornado research projects, 11J–176
Trace elements in atmosphere, 11.10–340
TRACE(E) (TRacking And Communication, Extraterrestrial) system, 11.10–40
Trade inversions over the Caribbean, 11.10–338
Trade wind variations, 11.10–338
Transport of radioactive dust, 11.10–340
Trapped protons, 11.10–218
Tropical photography, 11.10–55
Tungus meteorite, 11.10–121
Turbulence effects on rockets, 11.10–233, 11.10–331
Turbulence in ionosphere, 11.10–112
Turbulence measurements in flight, 11.10–277

Turbulence spectra, 11.10–283
Turbulence spectrum of sun's thermal convection, 11.10–90
Turbulence theories, 11.10–23 11.10–282
Turbulent diffusion of radioactive substances, 11.10–60
Turbulent diffusion theories, 11.10–286
Turbulent flow, 11.10–330
Typhoon frequencies, 11.10–296
Typhoon rainfall, 11.10–127

Ultraviolet radiation measurement techniques, 11.10–43
Ultraviolet solar radiation, 11J–103
Umkehr effect, 11.10–264, 11.10–268
Umkehr effect evaluation, 11.10–270
U. S. satellite, 1958 Alpha (Explorer I), 11J–66, 11J–115, 11J–163, 11J–183
U. S. satellite, 1958 Beta (Vanguard I), 11J–10, 11J–66, 11J–112, 11J–130, 11J–159
U. S. satellite, 1958 Gamma (Explorer III), 11J–159
U. S. satellite, 1958 Epsilon (Explorer IV), 11J–142
U. S. satellite, 1959 Iota I (Explorer VII), 11J–6
U. S. satellite, 1960 Beta II (Tiros I), 11J–12, 11J–43, 11J–53, 11J–86, 11J–124, 11J–147, 11J–166, 11J–167, 11J–192, 11J–200, 11J–201
U. S. satellites, 11J–29, 11J–64, 11J–68, 11J–89, 11J–92, 11J–134, 11J–184, 11J–186
U. S. White Sands Signal Corps Agency, 11J–177
Upper air circulation, 11.10–288
Upper air observation techniques, 11J–95, 11J–127
Upper air observations, 11J–136
Upper air temperature distribution, 11.10–344
Upper air temperature gradients, 11J–15
Upper air temperature measurements, 11J–79
Upper air temperatures, 11J–80, 11J–121, 11J–141
Upper air turbulence, 11.10–108
Upper air wind, 11.10–335
Upper air wind frequencies, 11.10–343
Upper air wind observations, 11.10–305
Upper air wind trajectories, 11.10–344
Upper atmosphere, 11J–122, 11J–132
Upper atmosphere composition, 11.10 262
Upper atmosphere densities, 11.10–262, 11J–7, 11J–18, 11J–59, 11J–61, 11J–66, 11J–70, 11J–80, 11J–90, 11J–91, 11J–121, 11J–129, 11J–137, 11J–140, 11J–141, 11J–143, 11J–160, 11J–161
Upper atmosphere densities (225–650 km), 11J–130
Upper atmosphere density data, 11J–142, 11J–163
Upper atmosphere density measurement techniques, 11J–38 11J–62, 11J–63, 11J 152, 11J–182
Upper atmosphere density measurements, 11J–30, 11J–39, 11J–42, 11J–71, 11J–79, 11J–96, 11J–98, 11J–107, 11J–148, 11J–157, 11J–159, 11J–162
Upper atmosphere density observations, 11J–139
Upper atmosphere density variations, 11J–89, 11J–92 to 11J–94, 11J–134
Upper atmosphere instruments, 11.10–247
Upper atmosphere pressure measurements, 11J–30
Upper atmosphere properties, 11J–19, 11J–80, 11J–96
Upper atmosphere research, 11J–45, 11J–72, 11J–84, 11J–125, 11J–175, 11J–177, 11J 185
Upper atmosphere structure, 11J–196
Urban climates, 11.10–259, 11.10–379
Urban climatology, 11.10–258

Van Allen belts, 11.10–215 to 11.10–219, 11J–78
Vapor pressure measurement techniques, 11.10–240
Variation analysis, 11.10–255
Venus, 11.10–103, 11.10–104
Vertical currents, 11.10–275
Vertical ozone distribution, 11.10–264, 11.10–268, 11.10–270, 11J–158
Vertical ozone distribution measurement techniques, 11.10–246
Vertical wind velocity calculations, 11.10–346
Vertical wind velocity distribution, 11.10–331
VLF radio wave propagation through transverse magnetic field, 11.10–51
Visibility forecasting, 11.10–287
Visibility in fog, 11.10–362
Visual observation of auroras, 11.10–169, 11.10–174, 11.10–183

Water vapor absorption spectra, 11.10–350
Water vapor measurements, 11.10–277
Weather analysis, 11.10–254, 11J–197
Weather control, 11J–22
Weather disasters, 11.10–293
Weather effects on nuclei concentration, 11.10–357
Weather forecasting, 11J–25, 11J–108, 11J–197
Weather observations, 11J–191
Weather satellites, *see* Meteorological satellites
Weather types, 11.10–383
Whistler analysis, 11.10–206
Whistler data, 11.10–207
Whistler dispersions, 11.10–213
Whistler paths, 11.10–211
Whistlers, 11.10–208, to 11.10–210, 11.10–212, 11.10–214, 11.10–221
Wind calculations, 11.10–326
Wind deviations, 11.10–335
Wind direction-speed relationships, 11.10–335
Wind effects on radioactivity, 11.10–340
Wind effects on rockets, 11.10–233
Wind-mass distribution in sea, 11.10–341
Wind profiles, 11.10–282, 11.10–345
Wind profiles over rivers, 11.10 337
Wind shear, 11.10–336
Wind velocity data, 11.10–54
World Meteorological Organization, 11J–146
WMO congresses, 11J–113

X-radiation, 11.10–217

Zodiacal light, 11.10–222, 11.10–223

INDEX OF GEOGRAPHIC LOCATIONS

NORTHERN HEMISPHERE, 11.10–256
AFRICA, 11.10–9, 11.10–382
Republic of the Congo
Leopoldville-Binza, 11.10–150
Tanganyika, 11.10–9
ASIA
India, 11.10–375
Ahmedabad, 11.10–270
Bombay, 11.10–58
Kodaikanal, 11.10–203
Japan
Yamagawa, 11.10–161
Persian Gulf, 11.10–352
Sharjah, 11.10–301
U.S.S.R. (Asia)
Siberia
Chukotka, 11.10–313
Vietnam, 11.10–17
AUSTRALASIA
Australia, 11.10–59
New South Wales, 11.10–366
Queensland
Brisbane, 11.10–142
South Australia
Adelaide, 11.10–115
New Zealand,
Invercargill, 11.10–171
EUROPE
Alps, 11.10–335
Austria, 11.10–54, 11.10–229, 11.10–377
Vienna, 11.10–374
British Isles, 11.10–267
United Kingdom, 11J–58
England
Cotswolds, 11.10–369
Oxford, 11.10–270
France
Aiguille du Midi Observatory, 11.10–257
Paris Basin, 11.10–7
Germany
Linz, 11.10–22
Niemegk, 11.10–192
Olbersdorf, 11.10–176
Wittenberg, 11.10–302
Hungary
Budapest, 11.10–258
Italy
Arcetri Observatory, 11.10–83
Norway
Southern Norway, 11.10–347, 11.10–348
Poland, 11.10–368
Switzerland
Arosa, 11.10–264
Geneva, 11J–113
U.S.S.R., 11.10–62, 11J–32, 11J–136
Estonia, 11.10–376
S.F.S.R.
Elbrus Mt., 11.10–380
Moscow, 11J–119
Ukrainian S.S.R., 11.10–5, 11.10–183
Yugoslavia
Split, 11.10–334

NORTH AMERICA, 11.10–230
Canada, 11.10–299, 11.10–372
Caribbean Region, 11.10–338
Swan Island, 11J–58
Trinidad, 11.10–310
Greenland
Godhavn, 11.10–214
United States, 11.10–343, 11J–58, 11J–101
Southwestern United States, 11.10–351
Alaska
Seward Peninsula, 11.10–378
Aleutian Islands, 11.10–211
College, 11.10–219
Arizona
Tucson, 11.10–297, 11.10–371
California
Los Angeles, 11.10–259
Colorado
Denver, 11.10–246
District of Columbia, 11.10–207
Illinois, 11.10–365
Quincy, 11.10–48
Iowa
Cedar Rapids, 11.10–48
New Mexico
Sacramento Peak, 11.10–228
Oregon, 11.10–333
Rhode Island
Block Island, 11.10–332
SOUTH AMERICA
Bolivia
Chacaltaya, 11.10–223

OCEANS, SEAS AND ISLANDS
Antarctic Regions
Antarctica, 11.10–1
Falkland Islands, 11.10–231
Arctic Regions
Arctic, 11.10–19, 11.10–287, 11.10–290
Bering Strait, 11.10–378
Soviet Arctic, 11.10–1
Atlantic
N. Atlantic Ocean, 11.10–277, 11.10–321, 11.10–322
Iceland, 11.10–298
Indian Ocean, 11.10–352
Mediterranean, 11.10–274, 11.10–281, 11.10–288, 11.10–304
Pacific
Central Pacific, 11.10–346
Red Sea, 11.10–352

SELECT LIST OF PERIODICALS

Note: This list contains the titles of the periodicals which regularly contain material on meteorology or geophysics and it comprises only a small percentage of the periodicals from which pertinent articles are abstracted. The form of serial entry adopted is given in bold face type below.

Acta Geophysica Polonica, [Warsaw].
Acta Meteorologica Sinica, [Peking].
Akademiia Nauk SSSR, Izvestiia, Ser. Geogr. and **Ser. Geofiz.,** [Moscow].
American Geophysical Union, Transactions, [Washington].
American Meteorological Society, Bulletin, [Boston].
Angewandte Meteorologie, [Potsdam].
Annales de Géophysique, Centre National de la Recherche Scientifique, [Paris].
Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. A and Ser. B, [Vienna].
Australian Journal of Physics, [Melbourne]
Beiträge zur Physik der Atmosphäre, [Frankfurt a. Main].
Ciel et Terre, Société Belge d'Astronomie, Météorologie et Physique du Globe, [Brussels].
Geofisica e Meteorologia, Società Italiana di Geofisica, [Genoa].
Geofisica Pura e Applicata, Istituto Geofisico Italiano, [Milan].
Geophysical Magazine, Japan Meteorological Agency, [Tokyo].
Hemel en Dampkring, [The Hague].
Időjárás, Magyar Meteorológiai Társaság and Országos Meteorológiai Intézet, [Budapest].
Indian Journal of Meteorology and Geophysics, [Delhi].
Journal de Mécanique et de Physique de l'Atmosphère, Société Météorologique de France.
Journal of Atmospheric and Terrestrial Physics, [London].
Journal of Geophysical Research, [Washington].
Journal of Meteorological Research, [Tokyo].
Journal of Meteorology, American Meteorological Society, [Boston].
The Marine Observer, Air Ministry, Meteorological Office, London.
The Meteorological Magazine, Air Ministry, Meteorological Office, London.
Meteorologické Zprávy [Prague].
Meteorological Society of Japan, Journal, [Tokyo].
La Météorologie, Société Météorologique de France, [Paris].
Meteorologiia i Gidrologiia, [Leningrad].
Meteorologische Rundschau, [Berlin].
Monthly Weather Review, U. S. Weather Bureau, Washington, D. C.
Polarforschung, Archiv für Polarforschung, [Kiel].
Przegląd Geofizyczny, [Warsaw].
Revista de Geofísica, Instituto Nacional de Geofisica, [Madrid].
Rivista di Meteorologia Aeronautica, Servizio Meteorologico, [Rome].
Royal Meteorological Society, Quarterly Journal, [London].
South Africa, Weather Bureau, Notos, [Pretoria].
Tellus, Svenska Geofysiska Föreningen, Stockholm.
Vsesoiuznoe Geograficheskoe Obshchestvo, SSSR, Izvestiia, [Leningrad].
Weather, Royal Meteorological Society, [London].
Weatherwise, American Meteorological Society, [Boston].
Wetter und Leben, Österreichische Gesellschaft für Meteorologie, [Vienna].
WMO Bulletin, World Meteorological Organization, [Geneva].
Zeitschrift für Meteorologie, Meteorologisches Observatorium, Potsdam.

TABLE OF CONTENTS

Meteorological and Geoastrophysical Abstracts, Volume 12, Number 10, October 1960

Foreword

Explanations

PART I. ABSTRACTS OF CURRENT METEOROLOGICAL, GEOPHYSICAL AND ASTROPHYSICAL MATERIAL

General ... 1569
Major Works-Textbooks ... 1569
Popular Science Books ... 1570
Handbooks-Manuals ... 1570
Monographs ... 1571
New Serials ... 1572
Glossaries ... 1573
IGY-Arctic-Antarctic ... 1573
Conferences ... 1575
History-Bibliography ... 1576
Applications ... 1576
Aeronautics ... 1576
Astronautics ... 1577
Radio Communication ... 1583
Industry ... 1585
Medicine and Health ... 1586
Radioactivity ... 1587
Agriculture ... 1588
Astronomy and Astrophysics ... 1588
Yearbooks ... 1588
Instruments ... 1588
Astrophysics ... 1589
Solar Physics ... 1590
Eclipses ... 1596
Moon ... 1597
Planets ... 1598
Meteors ... 1599
Radio Astronomy ... 1605
Outer Atmosphere ... 1605
Cosmic Radiation ... 1605
Ionosphere ... 1608
Auroras ... 161
Geomagnetism ... 162
Whistlers ... 162
Exosphere-Van Allen Belt-Zodiacal Light ... 162
Meteorological Observations and Instruments ... 163
Synoptic Analysis and Forecasting ... 163
Atmospheric Structure and Physics ... 164
Atmospheric Pollution ... 164
Radio Meteorology ... 164
Dynamics of the Atmosphere ... 164
General Circulation ... 165
Atmospheric Disturbances ... 165
Radiation and Temperature ... 165
Pressure and Wind ... 166
Turbulence ... 166
Upper Air Winds ... 166
Aqueous Vapor, Hydrometeors and Hydrometeorology ... 167
Humidity, Evaporation, Condensation, Fog and Cloud ... 167
Precipitation, Rain, Snow and Hail ... 167
Climatology and Bioclimatology ... 167
Climatic Changes ... 167
Microclimatology ... 167
Bioclimatology ... 168
Miscellaneous ... 168
Cosmic Influences ... 168
Optical Phenomena ... 168
Electrical Phenomena ... 168

PART II. ANNOTATED BIBLIOGRAPHY ON THE USE OF SATELLITES IN METEOROLOGY, p. 1683–1729

PART III. RECENT MONOGRAPHS AND CONTENTS OF RECENT SERIALS AND COLLECTED WORKS, p. 1730–1741

PART IV. AUTHOR AND SUBJECT INDEXES

Index of Authors ... 174
Index of Subjects ... 174
Index of Geographical Locations ... 175

List of Periodicals ... Cover